REACH

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Isolation in a Multigeneration Household During the COVID-19 Pandemic

Abstract

Multigenerational household arrangements—defined as single households consisting of three or more generations—have long been practiced for economic and cultural purposes. However, because transmission between household members is a primary source of COVID-19 infections, the pandemic has turned multigenerational living arrangements into a high-risk factor. Past research has shown that most multigenerational households are comprised of individuals that came from under-privileged backgrounds. Thus, this paper aims to specifically highlight the unequal burden of COVID-19 through our brief literature review on recently published scientific papers discussing the impacts of COVID-19 on the Latinx population, women, and multigenerational households. Furthermore, this paper will also present information on the research we had conducted and our findings on how 22 multigenerational households (comprised of fifteen Latinx, six Filipino, and one Vietnamese households) navigate care and safety precautions during the COVID-19 pandemic. The primary focus of our research project was to understand if isolating and quarantining in a multigenerational household is feasible when a household member became sick with COVID-19 or was exposed to airborne particles containing the virus. By examining socio-demographic data and observing the characteristics of 22 multigenerational households, we had found that over half of our research participants believe that isolating and quarantining at home are feasible due to factors such as planning ahead despite having limited financial, social, and other material resources.

Keywords: COVID-19, Isolation, Multigenerational Households, Filipino, Latinx, Vietnamese

Background

COVID-19 has been a life changing event that the world has had to learn to live with and adapt to. This virus—which had originated in Wuhan, China in late 2019—was believed to have been transmitted from bats onto humans. There was heavy speculation that this was caused by the live markets in China where animals are sold for food and contain natural predisposed diseases. As a result, COVID rapidly spread throughout the world becoming a serious world-wide epidemic by early 2020. There were immediate safety measures implemented to reduce the spread of the virus such as social distancing, mask wearing, hand washing, stay at home orders, lockdowns, and avoiding crowded spaces. Hospitals all over the world were quickly becoming overcrowded with positive COVID patients seeking treatment. Two defense strategies were implemented which were "active attack" to control the spread and "organized defense" for mitigation of the virus (Trilla, Vilella, 2021). Active attack includes getting people tested for the virus and keeping track of exposure victims through contact tracing. If a COVID positive individual is found, they must get tested, be placed in quarantine for a maximum of 10 days, and receive any treatments necessary. Any individuals who were in close contact with the COVID positive individual will also be required to get tested and will have to remain in quarantine and complete isolation anywhere from 10-14 days. This keeps the possible exposure victims away from others and helps prevent the spread of the virus. Organized defense consists of the safety measures

implemented to keep everyone as safe as possible such as mask wearing, social distancing, avoiding crowded areas, the frequent washing and sanitizing of hands, and lockdowns. These are safety measures that need to be followed regardless of a vaccine being available because there is no certainty surrounding the effectiveness of the vaccine against the spread of COVID-19. COVID-19 is a highly contagious disease that is easily spreadable, and we can see this examining the basic reproduction number (Ro). "R0 is also an average value: there are people who, although infected, will not transmit the disease to anyone, while others may transmit it to many more people. For COVID-19 it is believed that 80% of infected people do not transmit the disease to others, while the remaining 20% are the main transmitters. These individuals, sometimes called super-spreaders" … (Trilla, Vilella, 2021). Because of its high level of transmission, COVID-19 has been proven to be 10 times more deadly than the seasonal flu. It is highly recommended that both symptomatic and asymptomatic individuals get tested in order to execute the correct plan of action such as quarantining within the household or finding an alternative to quarantine. While the COVID-19 pandemic has brought upon us a multitude of unforeseen events and ramifications, it has also catapulted and brought to light the plethora of socioeconomic inequalities that disproportionately affect people of color (POC), especially families who live in multigenerational households. As such, POC oftentimes have to make decisions that will undoubtedly end up affecting the entire household. Moreover, COVID-19 has been a catalyst for these types of decisions, and POC, in comparison to affluent families, are also often seen scrambling with limited resources at their disposal, ranging from a lack of food, health care insurance, secured housing, ETC. For instance, while individuals in the United States that identify as Latinx account for 18% of the population, they represent an estimated 33.8% of the COVID-19 cases that take into account race and report it (Tai et al., 2020). Additionally, living conditions are further exacerbated by the fact that approximately 19% of Latinx live below the poverty line (Tai et al., 2020). The forecast of topics that will be discussed within this paper include the following: COVID-19 implications among Latinx communities, social norms within the pandemic, family relationships among multigenerational households, and COVID-19 transmission within densely populated communities of POC. As such, the following peer reviewed sources were retrieved via our schools database and will be further analyzed in the following paragraphs.

Literature Review: Unequal Burden of COVID-19 on Minorities and People of Color

The Impact of the COVID-19 Pandemic on the Latinx Population

While studies regarding the long term effect and longitudinal studies of COVID-19 among multigenerational households are still incipient, short term studies since 2020 have taken off and have discovered socio-economic disparities among people of color in highly dense urban communities. As a result, the study titled, The Impact of COVID-19 on the Latinx Population: A Scoping Literature Review, identified 16 studies and synthesized that the prevalence of COVID-19 among latinx populations is higher and more prevalent than non-hispanic white (Pg. 796). As such, it is evident that health disparities disproportionately affect less affluent communities that may not have the financial means. To corroborate, within the study, it is estimated that higher than 70% of Latinx individuals do not have sufficient that would amount to 3 months worth of living expenses (Carethers, 2020). Therefore, taking into account the procedural challenges that one is faced contracting

COVID-19, or merely being exposed to an individual who has tested positive, financial armageddon is almost bound to strike place among multigenerational families, which, in average, a Latinx household size is comprised of 3.8 people (MEPS database), are at higher risk of contracting the virus. Further ramifications range from unpaid work days, to potentially infecting the rest of their families and further risking financial instability."Lower income families, disproportionately African-American, Latinx, and immigrant, rely on income from members working in job conditions at high risk of infection. Crowded multigenerational living conditions make social distancing difficult in households (CDC, 2020). Living with racial residential segregation, at a distance from healthcare facilities and grocery stores, makes it harder to get needed care or garner supplies for stay-at-home precautions. Lower income families' livelihoods require leaving home and taking public transportation daily to work in the service sector, factories, and/or other crowded conditions, where personal safety is often compromised for the sake of a paycheck needed for family survival. These families live with the daily fear that COVID-19 will be brought into the home from work settings and travel to and from work" (Rolland, 2021). These families don't have the same access that white families do, such as jobs where there is less exposure, owning their own vehicles, having access to healthcare/ hospitals, and a reduced number of individuals occupying a house at any given time. Family clustering is a phenomenon where multiple generations are all living in the same household at the same time and is very prevalent among families of color. These reasons include both cultural and economic factors and lead to the virus becoming easily spread from person to person. These cramped living conditions are very unfortunate but are the result of disparities.

BIPOC and Women in the Midst of COVID-19

BIPOC (Black, Indigenous, and People of Color) populations have been identified as most at risk for experiencing family clustering, which we believe compounds the stress in dealing with COVID-19 and disproportionately exposes them to the many other ethical challenges tied to family clustering. People of color are twice as likely to live in multigenerational households, which makes spreading the virus easier. Thus, in a cruel irony, a normally positive and admirably common attribute of non-White cultures—the extended communal experience of raising, living, and caring for one another in what are often multigenerational homes—has been warped by COVID-19 into yet another risk factor for poorer outcomes" (Bliton, Buren, Cunningham, Weber).

A systematic review in the study conducted by Nafilyan et al. uses retrospective data from the 2011 Census in England to investigate the difference in risk of mortality and hospitalization rates across different race and ethnicity groups. The findings of the study have shown that ethnic and racial minority groups in the UK have also been disproportionately affected by the COVID-19 pandemic. One significant driver of this inequality is attributed to the multigenerational living arrangements that the ethnic minority populations in the UK are more likely to practice.

From the data of 10,078,568 adults aged 65 or over in England—who were not in a care home in 2019 and were still alive in March 2020—54 percent had identified as female and 93.9 percent had a White ethnic background. 9.7 percent (n =987,306) of these elderly adults lived in a multigenerational household without dependent children and 1.9 percent

(n = 199,112) lived in a multigenerational household with dependent children. Among the population of elderly adults that live in multigenerational living arrangements, just over ten percent identify as White, while 58.7 percent identify as Bangladeshi, 58.8 percent identify as Pakistani, and 45.8 percent identify as Indian (Nafilyan et al., 2021).

From analyzing this publicly available data, the researchers conclude that there is a positive association between the risk of COVID-19 death and living in a multigenerational household. The results further identify that living in a multigenerational household has an especially adverse impact on women of South Asian background who live in multigenerational households with dependent children.

Similar results are obtained in a study conducted by Thomas et al.—a study that aims to identify who is most impacted by the COVID-19 pandemic in the United States. The study found that women are disproportionately affected by the pandemic as 2.3 million women have fallen out of the workforce in the United States. Research has shown that this is due to the increased demand for childcare as schools have switched to remote learning. This is one factor that explains why studies have found that women are experiencing more stressful life events during COVID-19 in comparison to their male counterparts (Thomas et al., 2021).

The Ramifications of COVID-19 on Multigenerational Households

Behavioral supportis a key element in identifying how COVID-19 has uprooted social stability among multigenerational households, it is also critical to inspect how social support has changed throughout the pandemic, from a theoretical and applied view. As such, Gilligan et al., 2021 tackles prominent topics pertaining to social support. In essence, they draw from three perspectives, which are the life course perspective, the intergenerational solidarity model, and rational choice/social exchange theory. As such, they synthesized that while the pandemic may increase the relationship force of young and older relatives, it may also ache family tensions of the current household and those of posterity successors. Furthermore, communal values that are shared upon family members may also enforce family ties, but may also be the source of discomfort among family members. This, as a result, shows the pandemic may have deteriorated or expanded family bonds. On the other side, grandparents were also pushed to the brink, as they were oftentimes the ones providing care for their grandchildren, in light of their parents increased work hours. As such, while parental care may have decreased during the pandemic, family traditions that are often carried out in multigenerational households, also decreased due to the increased risk of exposure and transmission (Gilligan et al., 2021). Family clustering has proven negative for many reasons and only increases the spread of COVID-19 throughout the home. Those infected are normally minority groups who do not have the means to self-isolate, get tested, receive hospital treatment, and possibly might not even have access to the COVID-19 vaccine itself. Socioeconomics plays a major role in families contracting COVID-19 because the arrangement of living in a multi-generational household increases the risk along with them not having access to resources nor the insurance/finances needed to seek treatment. Some families do not have the means to protect themselves from contracting COVID-19 the way other families do. They don't have access to the Western tools and medicine that more fortunate families have access to. Even something as simple as frequent hand washing cannot occur because some families do not have access to water. "In fact, many of the

most affected groups lack capabilities to follow basic recommendations for curbing the diseases. For example, washing hands has been noted as "essential to contain the spread of COVID-19 and many other infectious diseases. Unfortunately, almost three billion people in the world have no way to wash their hands against coronavirus" (Patterson, 2020). These issues often are framed in terms of barriers to social justice and human rights, with implications reaching far beyond the illnesses themselves" (McNeely, Schintler, Stabile). Nonetheless, Harris 2021 analyzed salient factors that were attributed to the outbreak of COVID-19 in Los Angeles, specifically, among multigenerational households. In essence, it was found that while multigenerational households may have improved their ties, it may have also been severed by the pandemic. Moreover, in the article titled Association between overcrowded households, multigenerational households, and COVID-19: a cohort study, an analysis of a Bayesian ecological time series at what was called the ZIP Code Tabulation area in New York City, was noticed to be more overcrowded and multigenerational households were associated with higher suspected COVID-19 cases themselves. They came up with a measure that was modified by the incidence rate ratio of the cases of COVID-19 every 10,000 population. The final representation was navigated for "ZCTA-level sociodemographic factors" As mentioned in the article posted on June 22, 2021. This had certain factors such as the status of poverty, racial status, and the median income, as well as the generality of conditions that relate to the Coronavirus disease, such as hypertension, heart disease, asthma, etc. The results had concluded that "39,923 suspected COVID-19 cases presented to emergency departments across 173 ZCTAs in NYC. Adjusted COVID-19 case rates increased by 67% (IRR 1.67, 95% CI = 1.12, 2.52) in ZCTAs in quartile four (versus one) for percent overcrowdedness and increased by 77% (IRR 1.77, 95% CI = 1.11, 2.79) in quartile four (versus one) for percent living in multigenerational housing. Interaction between both exposures was not significant (βinteraction = 0.99, 95% CI: 0.99-1.00)." This is important to understand since we do not generally see statistical data of the independent factor of multigenerational households being most at risk. It has also been said that "COVID-19 lockdown policies globally have centered on some version of home quarantine, and/or school closure, leading to increased household "dwell time." Meaning, few of the policies that had been reviewed were in a sense proven to be effective for the transmission of the virus, however in a smaller context the implications of loyalty to these certain measures for the people who lived in close proximity to their family members, being overcrowded, were not having good results.

Methodology

As a preface, the information needed for this research was based around the participants' individual experiences and their common knowledge of COVID-19 at the beginning of the pandemic, during the middle, and now with the Delta variant. Within the methods that were utilized for this ethnographic study, the first step was to collect the data via interviews, in which the team collected a total of 22 interviews that lasted approximately YYYY and contained 98 questions. The questions tackled and engaged topics such as economic status, family background, and general knowledge of COVID-19, three of them being sorting cards where the interviewees demonstrated and ranked what they believed put their family members at risk. As well as a variance of multiple choice questions. The sorting cards also helped demonstrate what the interviewee could do before vaccination and after vaccination. Furthermore, additional components within the interview that were

observed, was the ability for participants to take into deep consideration possible factors that can make them more exposed to the disease, in particular how their multigenerational household was more at risk due to close proximity. Post interview, we took a look at all the information provided by the interviewees to conduct an analysis that helped us narrow down what interview material would benefit our research topic on how isolation, or lack of, affected them during the pandemic.

Data and Results

Characteristics of Households

We interviewed 22 multigenerational households for our study on isolation in multigenerational households during the COVID-19 pandemic. Fifteen out of the twenty-two households we interviewed are part of the Latinx community, six are members of the Filipino community, and one household identifies as a member of the Vietnamese community. Regarding household sizes, our study found that the lowest number of inhabitants in a given household is four members, whereas the highest number of inhabitants in a household is ten. The study found that the average size of multigenerational households averaged approximately 6.4, with six members being the most common size of a multigenerational household. Observing the number of bedrooms, we found that the highest number of bedrooms in a single multigenerational household was six, and the lowest number was one. The average total of bedrooms across the interviews averaged approximately 3.1 bedrooms. The study had also observed whether a household has master bedroom, defined as a room with a bathroom inside of it. Eleven households shared that they had at least one master bedroom in their residence, nine households have no master bedrooms, and for three households, the number of master bedrooms was unclear. Looking at the number of bathrooms in each household the lowest number of bathroom in a residence was one, the highest number was 3.5, while the average number of bathrooms across all multigenerational households interviewed averaged at approximately two bathrooms.

COVID-19 and Feasibility of Isolating in a Multigenerational Household

From the study we have conducted, we also surveyed how many of the multigenerational households interviewed had at least one household member who tested positive for COVID-19 between April 2020 through October 2021. Our data showed that ten of the twenty-two multigenerational households (eight Latinx and two Filipino households) had at least one member tested positive for COVID-19. Furthermore, the data also revealed that nine out of the twenty-two multigenerational households (five Latinx, three Filipino, and one Vietnamese households) believed that they did not have any household members who tested positive for COVID-19 between April 2020 and October 2021, while data for the remaining two multigenerational households (one Filipino and one Latinx household) were unclear.

The interviews of 22 multigenerational households have also shown that it was feasible for thirteen out of twenty-two multigenerational households (ten Latinx, two Filipino, and one Vietnamese households) to isolate at home. Moreover, the interviews have revealed that isolating at home is feasible but would be challenging for four out of the

twenty-two multigenerational households (one Latinx and three Filipino households) interviewed, while data is unclear for the two remaining multigenerational households.

In addition to surveying for a multigenerational household's ability to isolate or quarantine at home, our interviews also aim to observe how many households have plans for isolation when at least one household member is exposed to COVID-19 or when at least one household member tested positive for COVID-19. Among the 22 multigenerational households, twelve households (eight Latinx, three Filipino, and one Vietnamese households) have plans for isolation or quarantine for when at least one person in their household tests positive for COVID-19. From our interviews, only two Latinx multigenerational households do not have plans for isolation or quarantine when at least one person in their household tests positive for COVID-19, while two multigenerational households (one Latinx and one Filipino households) have plans for isolation or quarantine for select members of their households only. Moreover, two multigenerational households (one Latinx and one Filipino) do not have specific plans and data for four multigenerational households (three Latinx and one Filipino households) were unclear.

Analysis and Discussion

Systematic health and social inequities have put minority groups and low income individuals at increased risk from COVID-19. From the 22 interviews we have reviewed and conducted, a pattern emerged, where many multigenerational households are mainly formed for economic purposes (thirteen out of the twenty-two multigenerational households). Within these various interviews, one common theme observed was that many individuals living in multigenerational households stated that rent was too high and expensive, as well as housing costs have increased and have made them feel uncomfortable to pay. It was also noticed that family members were losing their jobs due to the COVID-19 outbreak, and were moving back home to receive financial support.

Few of the other key points that were taken out of these interviews were the potential money that could be saved in the long run, and that more individuals in the household can likely contribute to childcare and/or adult care when in need of. This leads to having less worries to spend on these services outside the home. However, thirteen out of the twenty-four households are experiencing overcrowded living situations in which is the result of having limited living space. This makes it difficult and at times impossible for some to isolate especially when a member or members of the household contracted with COVID-19. The results have shown that multigenerational households needed to resort to staying in other places, such as other family members' homes, hotels, and/or in spaces like the garage when it is nearly impossible for them to isolate inside their houses. With that being stated, situations like such caused emotional anxiety, fear, and guilt for many. Among the fourteen multigenerational households that said isolating at home is feasible when family members contract COVID-19, thirteen out of fourteen households have plans for when someone in their households test positive. Five of these households have at least one member of the family tested positive for COVID-19. Based on the findings, planning is a key factor that allows a household member to have the opportunity and feasibility to isolate at home. These findings show that although it is possible, isolating in a crowded multigenerational household during the COVID-19 pandemic is a difficult process. Few of the limitations to this

study is that it is not entirely possible to explore the feasibility of isolating outside of the house as the interviews that were conducted do not give sufficient information regarding the struggle of multigenerational households that do not have enough space at home to isolate.

Conclusion

Over the past two years, COVID-19 has irrevocably changed the way we live, hitting minorities and those who have limited financial means the hardest. In the United States, we have seen an unprecedented number of hate crimes directed toward the Asian and Pacific Islander community. Furthermore, recent research and national statistics have shown that the Latinx population is one of the most vulnerable populations in highly dense urban communities, as they possess limited social agency and less disposable income. In conclusion, minority groups should have more resources made available to them to help combat COVID-19 such as access to health care, access to testing and vaccination, and paid sick leave if a family member comes down with COVID and cannot work. Structural changes should be made to create safer workplaces such as having less crowded working spaces, reducing capacity of personnel in a given room, and mask mandates. Individuals from underprivileged backgrounds should also be provided with more help in dealing with the pandemic because they are the ones who are disproportionately affected. In terms of living in a multigenerational household, individuals should try and lay out a plan in case a family member does come down with COVID and needs to be isolated. They should find a spare room, garage, or shed where the infected individual can stay while the virus runs its course to prevent the spread among other family members.

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Destiny

How has the transition to remote learning influenced the opinions of first-generation students on their role in the classroom?

Abstract

The scope of student obligation and involvement regarding their role in the classroom can vary, especially for first-generation students (FGS). The transition to remote learning can affect the student in exceedingly small ways, as simple as a student not feeling comfortable asking questions and can expand to more problems like the student's ability to be able to succeed in class. Enrolling in a four-year institution as a first-generation student is not easy as their role in the classroom seems nonexistent since FGS have a higher percentage of responsibility at home and are often not primarily focused on school. This makes it harder to adapt to online learning and understand their role in the classroom. In addition, students must master the "college student" role to understand instructors' expectations and apply their academic skills effectively to those expectations. It is important to study the transition from in-person learning to remote learning given that remote learning has changed the way that students comprehend material regarding the subject they are learning. Much of this literature rests on the goal of presenting more reliable information of first-generation students' opinions regarding their role in the classroom during the pandemic. While some research has acknowledged that online learning has affected students' understanding of their role in a classroom setting, many studies focus only on the struggles surrounding the student. However, it is extremely necessary to be able to research how first-generation students feel in the transition to remote learning because former research has justified that online schooling has changed student's ideas regarding knowledge, comprehension, and work ethic but not necessarily the opinions on the students understanding of their role in the classroom. Through surveys and interviews, we will be able to form our own research and opinion of how the transition to remote learning has influenced the opinions of first-generation students on their role in the classroom.

Keywords: First- generation; Online learning; college student; pandemic

Introduction: Reasoning behind conducting this study

The reason I am conducting this study is that as a lower-class men first-generation student I have had a firsthand experience when it comes to the transition to remote learning and the problems first-generation students have had in the progress into transitioning into hybrid learning. The purpose of this study is to present a more reliable comprehension of these students and first-hand data and knowledge regarding these students and to determine what differences, if any, exist in the way that these students' opinions on the transition from remoted-based learning into hybrid learning .Moreover, the reason we need to study the transition to remote learning is that remote learning has changed the way that students understand material regarding the subject they are learning. In addition, research has shown that students have tended to get lower grades, are less likely to perform well in follow-on coursework and are less likely to graduate than similar students taking in-person Given this information, we can justify why it is important to research more regarding remote learning and the effect it has on college students.

Despite the potential benefits of remote learning, many students feel unprepared in a hybrid course. This can be caused by challenges and constraints they are experiencing academically or personally in their lives. It can be difficult to succeed in remote learning without consistent, high-speed internet connectivity and functioning devices to connect to it, and (2) the ability to relate to and communicate easily with professors and teaching assistants (Katz, Ognyanova, Jordan). These necessities are challenging for first-generation students. Overall, first-generation students are more likely to have their educational experience negatively affected by a lack of basic internet services. They are less likely to have access to strong internet connections (above 10MB/s) and a slightly higher percentage of FGS (5.5% v 2.4%) rely on a mobile network for internet access (Supan,2021). Developing social skills can be harder if they have never seen or connected with their professor on a face-to-face level. Even though educators have used discussion boards, group projects and other social activities, students still lack the communication that is needed to succeed in those assignments and even discussions. First-generation students have suffered more severe social consequences compared to other students. FGS were already less likely to know someone on their course that they felt confident talking to about course-related issues, which potentially makes the transition to online or blended learning even more difficult for FGS (Hanson, Millican, Mates).

Previous studies have emphasized that students have expressed how their perceptions of their role have changed in response to the transition to online learning. They have also expressed their roles as students regarding the remote learning process. In characterizing these movements as role transitions, this model suggests that students who undertake supervised work experience need have needed to learn new skills and techniques about the role or roles within one setting, and the requirement to adapt or adopt a changed role in the new setting by the support of a group like setting (Auburn). Studies have also seen that students before processing into hybrid should be needed to work on communication skills with their peers, this was presented by group activities online that are enjoyable and involve talking and critical thinking. It will also strengthen their understanding of their role in the classroom as the students are to acquire conceptual knowledge and develop literacy skills. First-generation students face a harder transition to online since most of these students work better in an in-person environment learning face to face, as most of these students tend to have more questions than other peers. Davis (2010) reports that first-generation students are likely to limit themselves to "one or two sources of information" about their college role (30). As a result, integrating into this new culture is a much more fraught experience. First-generation students must learn not only the content of their classes but the social rules and roles of academia. Therefore, their first-generation students' opinions of their role as students have shifted in a negative impact, regarding their understanding of remote learning and the knowledge needed to succeed.

The scope of student obligation and involvement regarding their role in the classroom can vary, especially for first-generation students (FGS). The transition can affect the student in exceedingly small ways, as simple as a student not feeling comfortable asking questions or voicing concerns towards their professor. It can expand to more extreme problems like the student's ability to be able to succeed in class regarding their worries and the unknowing skills that are needed when considering the transition to hybrid learning from remote learning as well as their understanding of their role in the classroom. Even enrolling in a

four-year institution as a first-generation student is not easy as their role in the classroom seems nonexistent since they FGS have a higher percentage of responsibility at home and within their own financial situations, they are not primarily focused on school themselves making it extremely to adapt to online learning and understanding their role in the classroom. Much of this literature rests on the goal to present more reliable comprehension of first-generation student's opinions regarding their role in the classroom during the pandemic and first-hand data and knowledge regarding these students as well as, determining what differences if any, exist in the way that these students' opinions on their role in the classroom and how they feel preparation wise on the transition from remote learning into hybrid learning. While some research has acknowledged that online learning has affected students' understanding of their role internalization places, many studies preliminary focus only on the struggles surrounding the student I argue that it is important to research core skills and knowledge that the student lacks due to their development from an early age and ongoing situations these students face as well as considering the data that we will collect through surveys and interview's to be able to support and expand the knowledge regarding the transition to hybrid learning from remote learning.

2. Methods used to collect participants

Approximately 20-30 students would be the amount for involvement in this study. This will simply be based on the number of volunteers that will want to take part due to the students having the time and interest, this number can vary according to the number of students who are willing to take part. They will be taking part in both the survey and interview questions; it would vary if any students decided to op-out since it is voluntary. It will be conducted on (zoom) so it will be around the student's schedule. In our research, we will be giving 20-dollar gift cards to all participants who complete the whole interview process includes (the survey and zoom interview part). The study will be presented to the participants through email (CPP (Cal Poly Pomona) accounts). They will be primarily students that are part of EOP (Educational Opportunity Program), MASA, FYE, I AM FIRST, etc. The primary reason these clubs are targeted is that they hold a majority of first-generation students. They will be presented with all forms; however, they will be sent the consent form before they are sent any other forms.

Participants will be recruited voluntarily. The way that I will approach the potential subject is by emailing clubs as well as organizations that primarily focus on first-generation students or students, in general, I will be sending a professional email to the club's presidents then I will send out an email once approved from them towards the students that are part of their organization. Therefore, they will receive an email regarding the research and what they will need to do if they decide to take part in it as well as compensation of $20 in bronco bucks if they complete the research. I will express how it is 100% voluntary.

Hello!

We are conducting A study to examine the opinions regarding the role in the classroom during the pandemic and firsthand knowledge regarding this it as well as determining what differences if any exist in the way the students' opinions on the role in the classroom and how they feel preparation wise on the transition from remote learning into hybrid learning. The Cal Poly Pomona Institutional Review Board has reviewed and approved for conduct this research involving human subjects under protocol IRB-22-9

We are looking for students that are interested in sharing their opinion regarding their experience during the pandemic as a student at Cal Poly Pomona . The research will consist of two questionnaires, one survey that will be done online in a separate doc and the second will be an interview online over zoom. The survey questions will be close ended questions and the interview questions will be open ended questions. This research will all be voluntarily based, and the interviews will be conducted on zoom and online!

Upon the conclusion of the study, you will receive compensation of $20 in bronco bucks for you to use at the bronco bookstore!.

If you are interested in participating in this research please feel free to contact me at dealmaraz@cpp.edu or my supporting principal investigator, Dr. Mary Anne, a Professor in the Political Science Department. Office number is 94-309, his office phone number is (909) 869-3879, and her e-mail address is maryannem@cpp.edu

We hope that you will consider being a part of this exciting research opportunity! Your participation would be greatly appreciated! I look forward to hearing from you.

Sincerely,

Destiny Almaraz
College of of letters, arts and social sciences| Political science|Rio undergraduate program)
Pronouns: she/her/hers

Figure 1 The email that was sent to clubs and program to recruit these participants.

3. Methods used to collect the data

The design involves one survey and interview questions(attached). Each part is part of the course, but only responses from students who consent to take part in the study will be used (discussed later in the protocol). Students will be told about a study I am conducting that involves the level & type of student opinions on their role in the classroom as first-generation students. Each survey will have language reminding students that their participation in the study is voluntary & that their decision to take part in the study. The study uses a correlational design. The independent variables are measured by the questions involving an independent variable: Transition to remote learning and a Dependent Variables: First-generation Student opinions about their role in the classroom. The dependent variables are measured open-ended questions asking about student opinions through the remote learning process the identifying data that will be collected in the survey includes Bronco ID Number (BIN), year in college at CPP, their work status including hours, involvement regarding clubs if they are a first-generation student, have any type of family responsibilities, The amount, of course, opinion involving aspects of the pandemic.

The surveys will be emailed the link to each survey separately. The survey will have a page 1 with the consent form as it as for participants to mark "yes" or "no." Page 2 of the survey will include the questions concerning their opinion on learning remote, and hybrid.

Survey Questions

Q1: As of Spring '22, what is your current standing at CPP?

    A. Lower year student (Freshman or Sophomore)
    B. Upper year student (Junior or Senior)

Q2: Are you involved in any programs at Cal poly Pomona? If so please list them (ex:EOP, clubs/programs/etc.)

    A. Yes. _____
    B. No

Q3: Are you a first-generation student at Cal poly Pomona? (For the purposes of this study, please select "yes" if neither of your parents have a college degree).

    A. Yes
    B. No

Q4: Did you have a job during the academic semester during the pandemic? If so, what is the average number of hours you work in a week?

    a. I did not work
    b. I did, 5-8 hours
    c. I did, 8-15 hours
    d. I did, 15-25 hours
    e. I did, 25-40 hours
    f. I did, 40 plus + hours

Q5: Did you have any type of family responsibilities during the academic semester? (For example: caring for younger family members, including siblings or children; regularly assisting a grandparent or older adult relative; conducting household tasks such as cooking, cleaning, and running errands for multiple family members, etc.).

    A. Yes
    B. No

Figure 2 A survey questionnaire method that is used to collect data to be able to understand the students' feelings towards these topics in a closed ended format.

The second part for this student will be the interview that will consist of open-ended questions and involve communicating with participants. The participants will have a choice to take part in the interview and can have the choice to zoom with the camera off, or any changes that will make them feel conformable. This will be conducted through zoom asking questions involving their roles and students and their reflection on being a student during remote learning. These participants will vary among students at Cal poly Pomona with diverse backgrounds in all aspects. Thus, participants will be able to consent to each part of the study separately

Interview Questions

Q1. Can you tell me a little about what it was like to take classes online during the pandemic?

Response: _____

Q2: In your opinion, what do you think is your role/responsibility as a student in an online class?

Response: _____

Q3: Is there any difference in your role for an in-person class?

Response: _____

Q4: In your opinion, what role/responsibility do you feel that professors have for an online class?

Response: _____

Q5: Is there any difference in their role for an in-person class?

Response_____

Q6: Did you feel connected or supported by your professors and peers during the online and hybrid learning process? Why or why not?

Response: _____

Q7: At the moment, do you feel prepared as an individual student to transition back to in-person learning? Why or why not?

Response: _____

Q8: In your opinion, do you have any ideas how professors could make their students feel more prepared in their class?

Response: _____

Figure 3 An Interview questionnaire method that is used to collect data to be able to understand the students' feelings towards these topics in an open-ended format.

4. Results

Given the information, we were able to look at many judgments when it came to how first-generation students felt about themselves when it came to their role in the class during the transition to remote learning from in-person. As we had many different students answering the questions, we were able to see many students felt like their role as a student was a non-existing, they felt that they had a lot more responsibilities towards their family and that school were more like a hobby. Specifically, many students described how they felt like they did not need to attend class even though it was mandatory under the syllabus in a way they still felt like they did not need to attend if they simply did not want. Furthermore, many students also explained how the pandemic was interesting, to say the least, there is a big disconnect between them and the professor they felt that the professors themself did not make a lot of effort when it came to making the class entertaining and, in many ways, it was hard for them to stay motivated and especially them being in first-generation students there motivation is already not as strong. In addition, many students felt like they were not even learning any material but simply just "getting work turned".

Moreover, another key factor that we looked at is in-person classes and understanding the difference in students' views when it comes to in-person classes. In my student's eyes, the responsibility that the professors have toward the class is to use their time efficiently. The professor tends to ramble a lot and does not present certain things that are necessary for the class. Another main idea is to make the class context interesting; this was a huge topic for the participants as they want to make the material interesting will better expand students understanding of the context. Moreover, in the student's opinion, the responsibilities that a student has in-person class been two are to attend your class and actively listen and take notes. As others felt that their duty in an in-person class is to be able to get as much information as possible especially first-generation students sent a lot of them emphasize a financial aid has helped them extremely and not taking advantage of it would be wrong. Many students at this time felt extremely independent and would even say that their opinions on their role in online learning is non-existent.

The transition to in-person learning has made many of these first-generation students feel unprepared going into in-person class; about their social skills, and financial situations and many of them are taking about 4-5 classes each semester. The data has also shown that most of these students had a job during this period ranging from number 15-40 hours a week. As we tend to interview more participants throughout the period, we can conclude that the transition and understanding of students' roles have been significantly for first-generation students.

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Almutairi Shroug   Tales of Future Incidents – Dreams and Nightmares

In the Summer of 2018, in the Hijri calendar, it was Shaban, the month before Ramadan, the fasting month of Muslims. On those days in that month, I dreamed of my mom for three days in a row. The dreams were weird. Every time I woke up, I felt that there was something that my family had hidden from me. But when I called them to ask how are they doing, it seemed to me that they were doing good. But I was still dreaming the same thing.

One day, in the very early morning, I dreamed that my mom was holding her legs so tight and crying in silence, setting down in the hall of my grandmother's home, and it was dark, but the hall was lightened. I asked my mom: "Mom, are you crying?" she did not reply. She was staring at the white wall, and she did not want to look at me. She ignored me. I woke up from that dream, and I was sad. But I told myself. She is okay and she is doing good, and that was only a nightmare that I should not take it seriously. I prepared myself for school. After I left the home, I got a message from my eldest sister that our mom just got out, yesterday, from the operation room.

I was shocked. I was driving to school, and my sister did not know that I saw her message while I was driving. I was about to make an accident. I lost my thoughts and consciousness for a moment. I just stopped at a random crossroad, and I don't remember where it was. I believe I stopped in Claremont because it was on my way to school. I called my sister, but the signal there was bad. I got back to my car and drove few miles, then I stopped again to call her again. And still, the WIFI signal was not good to catch the call, it can only work with texting. When finally, my sister got the call and answered me, we could not hear each other well. I was begging my sister by sending her a voice note and I asked her to tell me what happened to Mom. My sister kept saying that she is okay, and that drove me nuts.

I am living far away from my family, and I cannot book a ticket to visit her during school time. I was lost. I felt like if something happened to my mom would it be my fault? I know that was weird to say, but that was what was going on in my head.
However, I drove back home, and I did not send an email to my professors. I was not feeling okay to tell them what was happening to me, at that day, I had a quiz in one of my classes. So, I get back to my room. I text my sister and told her: "If you do not answer, that would not be okay," I was about to get to fight with her. I called her again, then my mom picked the phone and she answered me. I asked her: "Mom is this you" she told me: "yes" then she said: "I cannot talk to you, because I want to sleep, I am tired." My sister took the phone and I asked her: "what are you guys hiding from me" my sister, Nora said that: "mom has cancer in her left hand, and the surgeon has decided to amputate her finger after few months of the check."

I threw my phone away. I cried. I screamed and said, "how did this happen??? when? how?

Referring back to my dream, or the nightmare that I kept dreaming of for a week before the incident. When I saw my mom holding her body and crying in silence, I thought that was a hint of something happening to her health. It looked like she didn't want to lose something in her body, and she was trying to find a solution as she was for the light that can guide her as she was looking at the white wall and staring at it. My dream was like foretelling me of a future incident that will happen.

I believe in my dreams. Usually, when I dream about something, it happens. I remember that one week before my grandmother passed, I dreamed that my friend called me to walk on the ocean surface to get across the green lands. And in the dream, while we were walking, my friend had told me about her experience when she lost her grandmother that passed away few months before my grandmother. I woke up, and I ran to my grandmother's room. she was sleeping. Then, as usual, I told myself that "this was a nightmare do not take it seriously, Shroug." But it was not a nightmare in its meaning, but I felt at that moment that something was behind that dream, I usually call any dream that makes me feel that there is something that is going to happen, a nightmare!

A week later from that dream, at 4:00 am, I was calling my friend on the phone. The same friend who I saw in my dream. She had asked me if I can go with them to the beach and have fun with all our sharing-friends. I told her: "sure, let's do it, girl." I don't know what happened to me when we end up that call. I realized that my grandmother did not get out of her room. So, I went to check where she was. I asked my mom, on my way to her room. My mom was drinking her afternoon coffee and watching TV. Mom said: "she is in her room." I went to her room, and to chock on my grandmother. I was sudden. I yelled and ran to call the ambulance. I saw her laid between her bed and the drawer.

And that was the End... An eternal rest grants unto her beautiful soul, O Lord

Almutairi Shroug   **The cover letter to the publication**

Dear publisher or the editorial review board,

The stories that I have written, I have experienced on different occasions. Whenever I introduce myself to people and tell them about myself, they get interested and want to hear more, and that has motivated me to write. When I see the curiosity from my friends and hear them encouraging me to write my experiences, I said, "Yes, I will do it." And here I am where I want to be. I would love to share my stories; they are like a memo about things that I faced and that happened to me.

Through nonfiction stories, people will get to know themselves better as well as knowing the writer, because they are reading somethings that happened in real-life and they may or may not experience it. They may learn from the stories how to deal with any relative cases that they are struggling with, or they may get motivated and entertained from real-life stories. Writing a nonfiction story is the window to learn and practice another life, and might be, another culture.

And here I am...

Studying Abroad in The United States of America

When I was sixteen, one of my dreams was to leave home and to study abroad. All I was thinking of were exploring and experiencing the western lifestyle that I haven't experienced before. Watching TV shows and movies have dragged me to a level where all I think about was to travel the world. I am from the Middle East, from a conservative family in the eastern province. I'm from Jeddah, Saudi Arabia. In there, we respect our traditions and believes, more than the western where you can see that they have a mixed traditions from every part of the world. I believed, at the time, that the western has adapted different cultures from each part or place in the world. The Eastern traditions are the opposite of the eastern, when it comes to what is acceptable and unacceptable in norms.

My story starts when I told my mom "One day, after high school, I will apply for a scholarship to study abroad." My mom was shocked. She did not welcome the idea at all. She thought that college students in the western countries the do partying and do drugs, and she still thinks like that till today. I remember, exactly, what my Mom has said to me, she yelled and said: "Get out of my face. I won't be happy if you apply there and get the accepted." My mom cares so much about me. I am the only child that she has raised. I have other sisters who are living with their dad. My other sisters and I have different dad. My mom got married twice, and none of her marriages last more than 10 years. And that 10 year is a questionable to me. I usually ask my mom, "why 10 for both marriages. Isn't that weird?" She always says that, "I believe in God's well and no one can prevent things to not happen. If God want it to happen, it will. God wants me to have 7 kids from different dads, so that I have you all and raise you alone"

My dad was irresponsible and he does not care about anybody. My mom is a strong loving single mother, who paid her life to raise me. She worked to feed me and pays for the essential things to make me feel happy. For her, only thinking about that I will be leaving the home to study abroad was not easy to be accepted. My dad does not care if I'm alive or dead.

I lived with my mom and grandmother in a small apartment. We are not poor nor rich. We do not have a trust funding in case something happened to us at home, but my mom works in the seaport and they pay her for a full coverage health insurance, even to me and my grandmother. We live in our own apartment not rented it. But that makes us living well in our country. Our currency makes us live well in our home, but when I calculate the exchange currency, I see that our money compared to the dollar, euro, and pound worth less and makes us live on the edge if we were living in any western countries.

What if something happened to me if I studied abroad. All I was thinking about at that time is to achieve my dream and experience a new life. However, to be qualified to get the scholarship, I must have a 90% or higher high school GPA. At the time, I studied hard, and I took extra classes and tutorials outside of school, In 2008, there were no online classes, so I booked my extra classes by phone and I searched for the teachers from the school's admirations and my friends who know someone who can teach outside of school.

So, back in the time, there were two chooses in the high school diploma. You either get into the scientific studies, where you take more scenes classes, like chemistry, physics, biology, and math, or you choose to get into the literature field, where you study the Arabic literature of the pre-Islamic era and the ancient literature of the Arabian Peninsula, history, art, geography, and Balagha (the art of speaking and persuading) and Naho, which is the study of Arabic grammar of the old Arabic language. So, when I was in high school, I choose the scientific approach, and I was an excellent student in the biology class and lab, but in the other classes, I was a B student and sometimes I get Cs. Science was my passion at the time, and my mom saw that passion in me. But still, she was not happy about that I want to go for my college, and me neither, because I do not want her to be sad, so the only reason that puts me bake is leaving her sad.

In the summer of 2010, the dissension was made. I applied for the scholarship and I got acceptance. From the western countries, I choose the United State of America. I talked to my uncle before I talked to my mom. I was crying. Crying so much. I don't want to hurt her feelings. Since 2008, I have not told her what I am going to do. Because she usually gets mad at me once I told her that I will leave. The only way that I thought of was to talk to my beloved uncle to convinces my mom. I don't want her to feel lonely after I leave her. Studying abroad is one of my dreams, and the only thing that I can do is talking to someone that my mom love and trusts.

At 7:30 pm, the telephone has rang, and I answered it. It was my uncle; his voice was creepy and cringy. He told me, "Where is your mom," I said: "she is sleeping," he told me: "wake her up," I said: "why!! Is there something happening," he said: "just wake her up." at the time, I knew that my uncle has not talked to my mom.

Because my uncle himself has told me that your mom is sick how would you leave her, and if something happened to you who would help you. The United States is not the next-door country and even its fly ticket is expensive to buy. However, I went to my mom's room. I told her that uncle Ahmad is on the phone. She asked me: "what does he want," I told her: "I don't know." it was such a weird moment. Something in my heart has told me there is something about me. I don't know what it is. My mom talked to my uncle for about 30 minutes. She was staring at me and surprised. I could not tell what is the call about. All I knew that it is about me because of how my mom looks.

The call ended. I asked my mom "what is it" she sat next to my grandmother on the blue oldest sofa that we have at home. She said nothing to me. I was scared. My grandmother has a problem with her hearing, so when we talk to her, we must yell. So, the secret at home isn't a secret, and since I have no school, I will know what it is if my mom talked to grandma. After fifteen minutes, my mom said that: "you will be getting married to Yasser a cousin of your uncle's wife. They have seen you in your uncle's daughter dinner when she gives birth to Jood." "What and when" I side. I was happy. It was surprising, but I would love to have someone with me. Also, I thought at that moment, if I get married and study abroad with him it would be so cool. So why not. I told my mom: "when is the engagement is going to be?" my mom was shocked. She feels I'm too young to get married at the age of 18. But personally, I feel okay with that. I have not told her the main reason, but I told her that: "I will get married sooner or later so why not."

On December 18th, my wedding was announced. I did not get to know my husband much. It was an arrange mirage. However, before our wedding place. We talked on the phone a lot. So, we kind of understand each other. And when I told him about my plan, he was into it. He did not say anything other than yes. He was encouraging me. So, we apply together to the University of Denver. And we prepared all the paper that we need to enter the United States. After we make sure that we are all about to book our tickets, I told my mom. She cried, but at the same time, she was happy because I am not going by myself to a place where I know no one, particularly traveling to the United States. My mom thinks that people there do not beehive well with foreigners. Unfortunately, United State to the middle eastern does not have a good reputation. What I mean that everything in the media represents the Americans badly, so defiantly, my mom cried. She asked me, where are you leaving us to a place where is not safe. She told me, it is your dissension, and now your husband is your guardian. In our belief and traditions, women must have men to take care of her. So, I got married, an arranged marriage to someone that I don't know, but my family knows his family. At the end, I came to where I want to be. But, recently a few months ago, my ex-husband and I get divorced, but I will never forget that he was the reason that I'm in America to study. My family would not let me come alone without him, but our marriage did not last long. I got married in December 2010, and after years, we got our divorced in 2020. My story is not ended yet. There are more to say and a lot of experiences to share, but since it is a short story of me on how I get to be here, than this is how I get to the beautiful country called The United States of America.

I believe that the home is where you born and raised, but also the home of your soul is where you feel you are happy and safe, and I am happy and safe with my American friends. They are such a great people and so loving, especially the Californian and Coloradoans (people of Colorado) whom I lived with.

The Impact of Teaching about Patterns of Human Variation on Non-Biology Major Students' Views of Human Races

Aquino Christian

Christian Aquino, Department of Biological Sciences
Mentor: Dr. Paul M. Beardsley
Kellogg Honors College Capstone Project

Avila   **Generative Art Research: Exploring and Representation in Art**
Jennifer   **and Technology**

Abstract

An aim is made to offer how generative art is comprehensive and provides fertile ground for both technical and speculative development; through the use of generative art, individuals can expand their knowledge through the use of a combination of art and computer science. Currently, technological advances have influenced all human activities, creating new dynamics and ways of communication. I disconnected myself from spontaneous expressions in my artistic development, turned myself into a more constructivist, and involved geometric expression. I reflect on my graphic art-making process and speculate on how it might relate to contemporary art practice. My intuition tells me that because visual designers tend to have skills for hacking type, color, and images, learning how to hack basic code can teach students to learn new ways of designing in different contemporary practices. So much about the design of algorithms is finding ideal solutions for the desired result, which is a concept that design students should understand. Ultimately, my art progressed into an algorithmic art in which devising rules, by algorithms, is the starting point and basis of my research. In this factor, some artists have integrated these advances in their creative process, which gives users the expression in literature as generative art, which refers to art that is created by a system that operates autonomously. Through this process, I will aim to find ways why educators should teach this and for artists to know the process of this creative practice.

<div align="center">Literature Review</div>

Introduction

When technology first boomed at the end of the 20th century, information and technology evolved. Which also generated new dynamics and forms of evolution and communication. Accordingly, in the fields of art, artists and creators integrated these new developments in their creative process, bringing in a new era by expressing themselves in procedural modeling, algorithmic art, and many different forms. These new forms conveyed works called generative art. With generative art, the artists use a system that operates autonomously by using a set of natural language rules, a computer program, the machine, and a procedural invention that is set in some level of autonomy contributing to the results in a completed work of art (Galanter, 2003).

Structure

Research, journals, and other scholarly articles pertaining to Generative Art are critical to my research. Research revolving to generative art and creative coding is important to individuals to obtain more experience within designing, but also more knowledge within their careers. Most research does not stray far from the ideas of algorithms pertaining to a sense of direction when designing, but people label a set of rules that the system follows. Typically, generative art is an enigma in research, something that has yet to be talked often about amongst artists and designers. By analyzing the successive fractions methods and

the algorithm studies, I have worked deductively and inductively to find the information I need to support my research. While I had hoped that more research would have been available to work inductively, relevant research is sparse and often outdated. Thus, using broad information and research relating to generative art and finding ways to implement this in school practice were used, and then relevant pieces were pulled out to construct the paper. The context of this paper is not a "universal" solution on finding ways to make the GenArt available, but a way to broaden the many aspects of the opportunities students can grasp in their future interests.

Key Terms and Definitions

Whenever working in a high-context language as well as high-context research, it is important to recognize that some words, while assumed to be common knowledge for those who have spent years in and around generative art researchers, are still important to clearly define. Especially the term generative art (GenArt), which commonly seems to be the use of an autonomous system for art-making since the 1960s. This definition generally describes the aspects of the term in many scholarly articles:

> *Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art.*

To clarify more, art that is created using a computer is not necessarily generative art. If one uses a paintbrush or a drawing application like Adobe Illustrator with a drawing pad to create an image, the computer is a tool for creating graphic art. This medium is much like a pencil or paintbrush that is controlled by an artist, the application is not acting autonomously. When continued, explanations and definitions must be clear, respectful, and inclusive. Some terms are also known by many things, with varying ways of calling or citing a singular concept, and thus they must be streamlined to clearly explain their function.

To begin, generative techniques are increasingly being adopted in many creative practices, from the visual arts and design, through music, cinema, and text. The word "algorithmic art" is one type of word called generative art. Within algorithmic art, it refers to art that is created through the algorithm, implemented as a computer program that reflects the outcome. The artist deviates a set of step-by-step rules, even if the algorithm cannot be read. When an artist deviates these rules, the program nurtures and refines it while the outcome is then revised by the human eye if it reaches their pleasing judgment. A programming language is a tool used to deviate GenArt. Programming language is just a way of making computers do what they're told, but autonomy must be involved to conclude itself to be considered generative art.

Even algorithmic art can create unpredictable and uncertain outcomes throughout the process. When the autonomy is predicting some level of degree, it is possible the artist is to be surprised by the outcome as anyone else. My research primarily focuses on a programming language which would be considered one type of generative method creating visuals. I will also be looking into Programming Blocks as well throughout my process,

but that is to be discussed yet. As the years pass and people find ways to create visual artwork, the idea accelerates. Through exploring and going into detail of different contemporary practices, more creative people are discovering this new form of creating art. Visual forms of generative art first appeared at the end of the 20th century through VDUs on computers and later in videos and also printing. In the ways of today's society, there are more ways people create designs to sell through a non-fungible token (NFT), Data Representations, and also many other platforms. For example, Electric Sheep is running on thousands of computers generating animations, or "sheep," that morph and duplicate based on algorithms, but also affected by the popularity of individual sheep among members of the worldwide community of users (http://www.electricsheep.org/). Although GenArt has evolved the way computers have in the past years, computers are not the most important tools, but the algorithms.

Indeed there are numerous *representations* of generative art and job opportunities which include:

Computer Graphics and Animations: Computer graphics and animations have been evolving for decades now which contributed greatly to representing a new practice of generative art. Generative designing through computer graphics is an iterative design process usually involving a program that generates an output based on certain constraints and variables defined by that program. Examples would include Perlin Noise for the synthesis of increasing realism in computer graphics such as fire effects, water, and clouds. This forms the basis for an interactive synthesizer for designing highly realistic Computer Generated Imagery (C.G.I.), especially seen in the use of animations that depict real-world behavior. There are several examples of GenArt including animated feature-length films such as those by Pixar and the hugely popular realm of video games.

The Demo Scene: For such artists and enthusiasts, generative art is no longer obscure or vague, but rather an ordinary method of creation. The demo scene is a worldwide non-commercial network of creative minds involved in the making of so-called 'demos'. Its purpose is to show off programming, visual art, and musical skills. Demos are computer-generated music clips that demonstrate what kind of graphics and sound effects can be done by using high-end computer hardware to its full possibility. Through a demo scene, it is additionally producing heaps of music, graphics, photos, text-art (ANSI/ASCII- Art), and many kinds of hardware platforms for several years.

Industrial Designing and Architecture: Industrial design is embracing the principles of generative design, first focusing on the unique aesthetic style that comes from organic shapes. Designers have found ways to implement automation in their processes. By providing basic sets of rules and objectives, computers can turn them into algorithms that create 3D shape grammars. There exists a wide variety of software programs that perform these tasks, and two of the most popular today for AEC and industrial design are Grasshopper and Dynamo. Generative creation tools bring opportunities that automation provides are frequently considered the main benefit of generative design in the innovation of new developments, buildings, and designs. In many systems like "Dreamcatcher," designers are allowed to input design objectives and also functional requirements like the materials, methods, and performance. The system follows these rules by generating and fabricating

these requirements. This practice is quite common in sculpting and exploratory as well.

Procedural Modeling: Procedural modeling is a type of method in generative design which rapidly generates ideas, saving time and money. Procedural modeling is an umbrella term for a number several in computer graphics to create 3D models and textures from sets of rules. L-Systems (computer graphics to visualize and simulate organic growth), fractals, and generative modeling are procedural modeling techniques since they apply algorithms for creating scenes. This is very much similar to architecture because of the techniques in computer graphics to create 3D models and textures from sets of rules. Procedural modeling is also used in ways to save money and time like in video games. If a programmer can teach a machine the parameters of what each object should look like, it can save hundreds of hours of tedious manual work. Through procedural modeling, the programmer generates what a building or object should look like with ranges rather than the computer self-generates options. This process lets the autonomy have some set of contributions to the outcome and the artists find what makes something look good.

Cinematic Spaces of Film: It states that the algorithmic essence of generative cinema significantly expands creative methods for the artists working with film and animation, but also provides a platform for a critical examination of the algorithmic techniques for conceptualization, script evaluation, and box-office assessment in the contemporary film industry. Utilizing these processes not socially associated with the institution of cinema and its cinematic narrative forms will accelerate the emergence of new social interactions, manifestations, and wonders. In ways through techniques by editing pixels autonomously like C.G.I, it reflects the outcome of the cinematic movie.

Clearly, any attempt to define generative art would have to include all of the above, as there is no obvious reason to privilege one form of contemporary generative art practice over another. Numerous forms can also include logos, generative machines like a mechanical pen plotter, installation space, literature, software developments, and many more. In some ways, each of these contemporary generative art practices gives more opportunities for artists to choose what practice suits their style.

The final piece of this research discusses the term "art." Declaring the work as art is a bold thing to say, but rather it expresses the creation of humanity and individuality of the human mind (2011). Furthermore, to describe the work as "generative" art means not only intend to express our individuality, but it expresses the mess and desertion of methods free of our control. Generative artists are much more like programmers than just artists. They have produced the unpredictable, welcomed it, harnessed it, and can fashion it into pleasing forms through various contemporary practices. It is crucial to mention that if generative art also included art produced by any kind of generating idea, then generative art would include all art, and it would lose its utility as a specific term.

Research Importance

Throughout the creation of this research, generative art for students gains more ways of creativity and availability which was at the center of this study. Specifically, art through coding in mainstream programs with recognition of how students can learn outside of their

curriculum that can assist develop their creativity and knowledge. The tool I'll be focusing on while being a part of Maya Stovall's research is a language called Processing. Through this learning and researching, the process provided me with an increased level of creativity within designing and coding. The computer can create solutions that many times would have been inconceivable to designers, simply due to the fact that human brains cannot process information the same way computers can (2018). Some research discusses opportunities within new fields, and also how GenArt can alter the future experience for individuals.

To begin, I invested a significant amount of time in learning a tool to create GenArt through coding. Processing is specifically intended to teach programming skills with visual feedback. The programming language is designed for creative coding like JavaScript and HTML, by considerably simplified and applied. Through my process, a sketch is needed to be done which is a series of functions given to the computer by the programmer, which is the artist. In my work, similar to my journey, only the starting point and theoretical destination are known. Learning the necessary functions, variables, and rules, I can see that the journey is often unexpected and surprising. With such parametric rules, the actual image is created as the result of a process. My artwork is always the result of expression and inspiration, but utilizing coding has made it the result of a calculation. However, it is not a mathematical art, but rather an expression of my artistic expression. The sets of rules I invent reflect the aesthetics of my art and what seems pleasing to my eyes. My composition is reached when finished work can dissociate itself from its logical content and stand convincing as an independent abstract entity. These algorithms can become very complex, that is to say, complicated to survey. A computer is needed and only in this way is it possible to overlay as many rules as necessary without losing control.

Within the field of designing, creativity is highly sought after. Brains sought it, societies do it, and evolution, but how do these things give advancement to artifacts and views that are new, surprising, and valuable? Throughout my process in generative art, there are creative techniques through coding and also the way a machine creates new structures when a programmer implements rules. New primitives emerge that were not explicitly defined when the system was specified, gathering creativity attributable to the system itself. Experts within generative art may also find easier ways through tricks to satisfy the eye of a viewer rather than the capability of a beginner. Many of these tricks create random variations that come from uncertainty which reflects the lack of creativity, in which an artist can achieve what they desire. This lets the algorithm stimulate what it wants to look rather than the artist's interpretation. But, not all generative art is like this. Other processes underlie works that can also be very insightful, leading to highly original, creative work. Finding creativity and aesthetic in generative art brings new fields open for artists to seek in and find a passion. Being detailed about where this creative instrument is attributed brings a greater comprehension of creativity through generative art.

The basis of all generative art resides in its engagement with the process. The process in generative art should be considered the primary medium of creativity, implying that the exclusive or dominant use of creative software or processes designed by others in one's generative practice is problematic. Much creative generative practice occurs outside the 'precious bubble' of the high art world, in areas of design and contemporary

technological culture (e.g. games, cinema, digital music). Many artists work across multiple practices (scientific, artistic, social, technical), making it limiting to consider generative art exclusively from a new artistic perspective. Artists have shown a patchy interest in generative art, probably for precisely this reason, which relates to wider tensions between art, technology, and mass culture. Many may see it as a generative system rather than calling it generative art, making it difficult for everyone to comprehend what art is. Additionally, generative art's emphasis on algorithmic techniques like randomness or chaos enables the algorithms' idea more than what the artists aspire it to be which often remains tied to the "irreducibility of the work of art"(1996). A discussion of authenticity is beyond the scope of this paper, in the case of AI-based generative systems such as deep learning, this problem teases issues around the creativity of algorithms.

Another vital piece of the research I am pursuing involves further discussions about those involved in the educational process for students pursuing ways to learn about generative art. It is known that students in grade school all around the world are beginning to learn about coding to empower children to control the computer and through experimentation build mastery skills in problem-solving, logical thinking, critical thinking, and counting. For students, learning to code is not the same as traditional subjects. Additional persons are involved in the learning process, including experts in coding and also teachers mastering the basics of coding. Instruction is not always direct, and that can be the largest problem. Students receive additional work and miss out on incidental learning. Researchers discuss these results are setting a trend around the globe promoting coding education with positive perceptions on teaching and learning (2015). However, teaching challenges the curriculum due to the lack of teacher training and also the experience available for young students and to people with limited technical expertise. A challenge for educators is to make a generative art experience available to young students and people with limited technical expertise. Can people construct accessible creative environments that bring the learner/artist in touch with the concepts around generative art? Such an introduction should lay the groundwork for people to move to mainstream systems more comfortably if they choose to do so. The current efforts to expand computer science (CS) education in K-12 schools, such as the "CS for All" initiative, highlight the need for all students to get an opportunity to study computing. Through computing, students will be able to learn in ways of programming language, coding, and creative coding. However, as recent research has shown, diversity in computing at the K-12 level remains problematic, and additional research is needed to look at how computer science learning environments can impact minority student interest and retention in CS.

Tempel (2017) looked into programming languages that may help educators to make generative art an easy experience to learn. This research focused on enabling more ways for the learner/ artist in touch with the concepts of generative art by looking at environments like TurtleArt that have been used in workshops over the past years. We will look at a programming language called TurtleArt that enables an easier and free of charge way for students and educators to look into GenArt.

In my research, TurtleArt is an app that allows the user to follow a sequence of commands that the user specifies by snapping together puzzle-like blocks. The blocks allow the turtle to draw lines and arcs, draw in different colors, go to a specific place on screen,

etc. With TurtleArt the aim is to create creative visuals, but it also teaches viewers ways in learning programming and visual effects. TurtleArt is a general-purpose language, letting users create commands for movement and drawing produced linear vector graphics through a small turtle on the screen. This is very different from coding on Processing, but allows younger students to create and manipulate directly using Blocks Programming. Block Programming utilizes a drag-and-drop learning environment, where users snap pieces together and the visual effect appears, a bit like a jigsaw puzzle. The functions express the structure of what the user wants by labeling it by action or by color, this lets the user decide what they would like to express visually. These visual clues let the programmer find it easier to understand what to do and express their creativity more easily. In some way, this style allows beginners to not make many errors compared to coding. From personal experience, while starting Processing, I made many mistakes but also learned and knew more due to already knowing how to code on HTML.
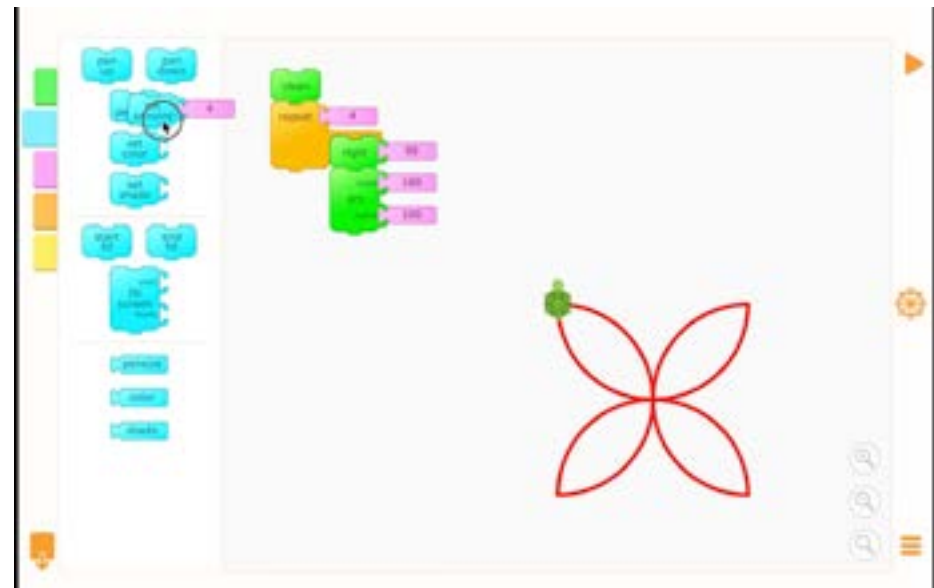
TurtleArt image of a flower and the code that created the visual effect

The programmer is allowed to change the pen size and color. The flower is drawn by 20 pixels. For setting the pen's color, it ranges from 0 to 100 with darker numbers ranging the lowest numbers, and the biggest numbers are pastel hues.

The programmer is allowed to enable whatever action that is available on TurtleArt that allows them to manipulate. This seeks the user towards an artistic expression, specifically to create drawings, and learning mathematics in programming, letting generative art aspire. One can find the program easy to use, not entirely teaching any hard difficulties compared to coding in Processing. TurtleArt is immaculately algorithmic, everything that appears on the screen is generated by the code (2017). Learning TurtleArt enables more of an artistic approach through Programming Blocks, giving beginners a better understanding of the domain in generative art, through art and mathematics. It is very limited in programming what the artists want it to do by allowing few actions, but it does focus on approaching the basics of generative art. Both Processing and TurtleArt come from a broader family of programming languages, but are free and can be taught and

learned easily, allowing future artists to find inspiration in generations to come through new technology. Without all of the information, including input from experts finding more availability for educators, students can not get a holistic education on generative art. Instead, they are missing something vital in learning a new artistic approach.

In 2016, the White House acknowledged the need to integrate computer science instruction across K-12 education in its CS for All, this innovative vowed to expand computer science education in U.S. public schools to succeed in the digital economy. However, there are wide disparities in minority students' access to computer science due to structural and social barriers, including technological skills and purpose of use, stereotypes, lack of role models, curriculum materials, or unconscious biases that discourage individuals from taking computer science classes. Together, gender, ethnicity, and socioeconomic status form a triad of elements that represent current diversity issues in computer science classrooms. " The issues are not only examples of girls and minority students being intimidated by the idea of gender norms but also reflect a broader computing culture where underrepresented students lack a sense of belongingness. The stereotypical view of computer science as a male-dominated discipline is a serious impediment to broadening participation. To try to address these diversity issues and presented some ideas, increasing new factors can diversify more possibilities in encouraging CS in classrooms. Creating an inclusive environment in the computer science classroom will increase students' feel welcome. In ways to emphasize inclusive classrooms would be bringing participants to show students examples of individuals from these underrepresented groups who are already part of the computing industry. Participants' experiences with creating more fair environments in computer science classes reflected the need to also foster students' sense of belongingness in the computer science community via active recruitment of students from underrepresented groups. Computer science is increasingly becoming an essential subject for students in the 21st Century (2016); and in the coming years, significantly more computing-related jobs are expected to be available than U.S. graduates with computing degrees and also for those who know coding and programming basics. The role of computer science education in K-12 education is, therefore, key in increasing diversity computing and providing opportunities for all students to take part in computing occupations. Through computer science, students can implement and learn a creative process through coding in art as in interest, a new passion, and also added experience in coding.

Review of Existing Scholarship

There are more and more examples of "generative art" emerging online, in galleries, and museums. Thousands of new artists and designers are learning and embracing creative computing environments in a few universities and art colleges, but there is a risk that this may be taught from an overly generic technical view. Finding ways for schools to provide a more critical understanding of generative art and equip students with both the conceptual and technical understanding is needed to be taught for students to get a hold on. Designers and artists can explore a variety of ways to implement generative art into their works and learn ways to hack basic codes. In many ways, my research focuses primarily on finding ways it can improve and implement many opportunities within the field, but also finding ways why this should be taken into consideration to teach students upon such a contemporary art practice. Generative art promotes the value of creativity, the creative industries, and smart

manufacturing within education to art, design, and the core science subjects. Focusing primarily on designers and artists, I looked closely at a scholarly article regarding ways to implement teaching generative art in STEM in the United Kingdom GCSE education. The intent of the research is solely to look through the lens of how design education might be recast as a special branch of the sciences for the UK's Creative Industries to be fit for the growth of emerging digital manufacturing markets. This is not a universal solution on how all countries should follow this path, but solely in the UK. My purpose in selecting this article is based on what information I found that may be subjective to use and deemed relevant to their educational system. In Graham Newman's, " How Might Generative Art be a Proposition for Cross-Cultural Learning in Schools," Newman offers in some way a roadmap of how practitioners, researchers, and educators prepare young people for future work in Europe through objects in designing 3D artworks through using a 3G device. Focusing and researching more scholarly articles within the United States Curriculum has yet to be discussed, but many countries like China, the United Kingdom, and Japan, have implemented many ways to add basic coding to students from K-12. Currently, only a handful of districts and colleges have found ways to implement a creative doing class, but it has yet to be talked about among many artists.

To offer some background context of the lack of art and design teaching, students opting for design and technology has decreased by an average drop of 43% from 2004 to 2016 in the UK. The educators have emphasized coding, but code what exactly? Many users are passive who learn but students need to nurture and understand the concepts of creative coding by learning ways for more job opportunities and reach art and design to a level not many have thought of. Many programmers are missing the point, and the UK has found ways to provide solutions on adding it towards STEM. Several studies from Goldsmiths Creative and Digital Arts BSc revealed that teaching generative art had the support of science and art teachers collaborating and students further. Simon Katan (2016) from the Department of Computing adds on:

The teaching of generative drawing techniques makes for an ideal introduction to creative programming. Learning these skills not only gives an intuitive insight into the power of computation and its expressive potential but also brings together concepts from across the Curriculum.
Through practical and creative experimentation students can enhance their understanding of a range of topics from across the curriculum including 2D and 3D geometry, abstraction in art, Newtonian physics, evolutionary theory, probabilities, and ecosystems.

In some ways, if educators shift parameters and focus on teaching outcomes that exist between the form of art and designing and programming altogether, this will answer the needs of future employers within a new workforce equipped with a hybrid skill set of art, design, and programming. The education system needs to fit for the 21st century, for young people to learn a mix of creative and technical skills to succeed. Within generative art, it adds to the growing glamor for a substantial change of direction in education.

When students graduate from high school, the ideal outcome is that they have received a quality education that instructed them in reading, writing, language, math, science, history, physical health and wellness, and art. Students are now assumed

to matriculate to college and continue their education in order to obtain a well-paying job. But with expanding more into technology, students and even children must be encouraged to understand how systems and their applications work through tactics between educators and students. Merging creative and tactical success to students can incubate the next generation of artists, designers, and engineers into a world of newer innovations. This in particular conveys the need to further research students' abilities to help them acknowledge generative art in their educational journey. Closing this gap not only leads the way to better outcomes for public education but greater innovations and more job opportunities.

Research Intervention

In the Art community, generative art has yet to be talked about amongst young artists. Many have yet not heard of such a topic and many do not know the vast opportunities it can bring to innovations in the artistic field. By letting artists, designers, and students acknowledge generative art, many may find ways for more opportunities within working, but also designing new changes. In my research, thousands of people are creating generative art and many have found ways to implement it into their classes like Professor Maya Stovall at Cal Poly Pomona with her creative coding class. Throughout learning and knowledge of basic coding for designing, I have found a new passion, but also looked at various scholarly researchers distinguishing what job opportunities generative art can give to people and what can students and children learn from the topic. The point is that generative art now represents a large group of people and demonstrates it as something to be implemented into the educational system. My research is meant for finding ways how designers and artists can expand their creative process through generative art, but I also want to focus on the fact that these designers and artists need to learn about the topic before finding it in their twenties that such a thing existed. If the educational system can find ways on implementing the topic in a school setting, many can be intrigued with such a discussion and can learn to find more ways to invest in learning the programming language while they are still young.

The two generative art platforms I discussed here can be used in the classroom setting. The programs are open source and thus have unlimited scope for contributions. These programs offer students a unit of inquiry from the arts and sciences, but educators will need to work together to teach these students what generative art is. None of this happens without the kinetic energy between students and motivated teachers. In discovering these works of research and methodology of learning the two programs, understanding previous research and how it can be furthered to better support students' education is essential. In my research, I hope to build upon what is known about generative studies, the variety of contemporary practices it can create, and also the additional ways students and designers can learn about the topic. By using previous research, the focus of this research can be narrowed to find the gaps that exist within newer research.

Conclusion

Generative art promotes an exhilarating direction where different workflows and ways of achieving nature-inspired systems can be combined in new and unexpected ways. Children and adults of all ages should experience technology as histrionic performance; the browser is a stage for creative coding; high impact, visually rich creative content, and the ability to

look under the hood of technology. This environment should be encouraged in schools to incubate the next generation of artists, designers, and engineers if the United States wants to remain a world leader in innovation. As mentioned previously, the two platforms discussed here can be used in the classroom and a few have been used critically to add on to students' knowledge within art and computer science. Generative art is becoming a key tool to various industries, providing several benefits. Teachers from the arts and sciences should enable more practices to work together, benefit the classroom setting, and also enable the major importance of the contemporary practice.

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The Impact the quantitiy and quality of Interracial Friendships has on an Individuals Personal and Collective self-esteem

Abstract

The present study looks at the connection between the quality and quantity of interracial friendships as it relates to personal and collective self-esteem. Thien, Razak, and Jamil's (2012) Friendship quality scale and a self-developed Friendship quantity scale investigated the relationship between university students' personal and collective self-esteem. A multiple regression analysis was conducted surveying 334 southern California university students, using Collective Self-esteem (CSE) (Luhtanen & Crocker, 1992) and Personal Self-esteem (PSE) constructs (Rosenberg, 1965). Multiple regression results found that the number of interracial friendships was not related to PSE (personal self-esteem) but significantly correlated with decreases in private and identity CSE. In contrast, friendship quality significantly correlated to increased PSE, membership, and private and public CSE. Implications developed from having a better understanding of collective self-esteem among those part of interracial friendships.

Keywords: collective self-esteem, interracial friendships, quality and quantity

The background information related to interracial friends looks at the quality and quantity, the personal and collective self-esteem.

Introduction

Interracial Friendships at the individual level

In this paper, we will be looking at interracial friendships, but first, it is necessary to look at what friendship is in the study. Friendship is a platonic relationship between two or more individuals. These relationships are built upon trust, closeness, acceptance, and safety. Similarly, interracial friendships refer to, "...personal relationships based upon mutual affection, caring, concern, or trust between individuals of different racial or ethnic backgrounds (Umaña-Taylor, 2004). For instance, if someone identifies as African American and has a Vietnamese friend, that would be considered an interracial friendship.

Gillespie et al.'s (2015) study focused on adult friendships and how they may impact an individual's overall life satisfaction. Their research also showed the importance of adult friendships and commonalities (e.g., gender identity) that friends may share. For instance, if individuals were to identify as women, they were more likely to feel more comfortable around other individuals who identified as women. While such findings are significant, it does not consider the difference in ethnicity related to interracial friendships. Another way that contributes to the lack of representation of interracial bonds some research shows the lack of diversity of participants. For example, one study found that women had more same-gender friends regarding alliances. Overall, this study shows the importance of gender difference and how it may impact an individual's well-being.

Page Gould (2014), looked at the differences between three different schools when it came to ethnically diverse or similar friendships. In Study 2, 148 Latino/a and White University students ages 17-32 after filling out the RSQ scale, the contact quantity scale, and the RSQ-personal were randomly assigned to the same race (control) or cross-raced friendship partner. Participants then spent time with their assigned friend for three days a week in 1-session. Participants were given a diary to document their experiences based on psychosomatic symptoms. Experimenters found that relationships with cross-race friendships improve the stress of individuals who expect race-based rejection. They were able to conclude based on Studies 1 and 2, that cross-race friendship improves the physical and mental well-being of people that assume that they will not be accepted when interacting with other races.

Impact of Friendship at the Group Level

Friendships have also been studied at the group level. Meaning that an individual's relationship with their social groups (e.g. ethnic groups) may impact identities related to those identified groups. Friendships can allow individuals to figure out who they are in terms of ethnicity. With that, most people have friends that are from the same ethnic group as them. This allows individuals to find comfort in being "themselves" as having a commonality of social identities is an important part of a person's life.

Yip (2020) found that in same-race friendships individuals are more likely to have the desire to explore and identify with their ethnic or racial identity. In the process that individuals go through in defining who they are, it is helpful to have people that might be going through the same process or have already experienced it. This allows for them to receive advice and education about their identities directly from those that identify the same as them. It is more comforting knowing people that are of the same ethnicities as it benefits identity development. Phinney (1997) looked at the ethnic identity of adolescents in elementary school. This study looked at intergroup and outgroup friendships (i.e. and saw the impact it has on the positive or negative attitudes an individual has in terms of their ethnic identity. Overall, Phinney found that two reasons contributed to an individual's outgroup attitudes. The first reason is ethnic identity increased with age and predicted positive in-group attitudes. This can be due to curiosity to learn more about their culture. With this, they are more interested in learning about their identities when they get older. This may impact how they perceive their ethnic group positively or negatively. In addition, individuals might become more mature and aware of the differences that they may share with friends or people they know. The second reason is that ethnic diversity outside of school contributed to more outgroup interaction in schools and predicted positive outgroup attitudes. This study shows the importance of diverse friendships in terms of ethnic identity. In addition, it looks at a potential explanation for teaching children at s young age about diverse friendships in school and at home.

Collective Self-Esteem

The difference between self-esteem and collective self-esteem is whether it leads to an individual or group-centered outcome. Self-esteem is based on individual outcomes. As it relates to friendship, it means that an individual's friendships impact their depression or

stress levels positively or negatively. Whereas, collective self-esteem is based on group outcomes. For example, an individual's friendship can have an impact on how they view their social groups, in this case, ethnic identity. CSE is self-esteem based on an individual's membership in their ethnic group. The scale is made up of 16 items and has four components.

Public CSE is when one's perception of how other people might view their ethnic group. In other words, it is the social perceptions about an individual's ethnic group. For example, the subscales used in the study stated that overall my social groups are considered good by others. Another example would be how an individual thinks about the way society views their ethnic group or the black community in a positive way (i.e. hardworking). Collective self-esteem is similar to ethnic identity. This measure is based on the Luhtanen & Crocker scale that is organized into four categories: private CSE, public CSE, identity CSE, and membership CSE. Average scores indicated that participants have a CSE.

Private collective self-esteem is the personal view of the quality of one's ethnic group. This concept relates more so to how individuals feel or personal emotions towards their ethnic group. Overall, it can be understood as the feelings one has about belonging to their ethnic group. For example, I feel good about the social groups I belong to. Another example would be how comfortable an individual feels with being a member of the black community. Membership is the worthiness of being a member of an ethnic group. For example, based on the sub-scale used in the survey is how an individual feels that they are a worthy member of their social group. A more specific example would be I am an active member of the black community. For instance, I make sure to attend an event every month to show my support.

Identity collective self-esteem is the connection or identification with one's ethnic group. An example based on the social groups an individual belongs to is an important reflection of who they are. An applicable example of this is an individual's active involvement in the Black Community is an important part of someone's life (if they identify as black). Findings suggest that the collective self-esteem scale is a reliable research scale. The rationale for CSE and the need for SE from group membership in research on intergroup friendship.

Present Study

The present study examines the connection between the quality and quantity of interracial friendships with personal and collective self-esteem (CSE). CSE is self-esteem based on one's ethnic group membership and how confident they feel within it. CSE consists of four subscales: Public (one's perception of how other people might view their ethnic group), private (personal view of the quality of one's ethnic group), membership (worthiness of being a member of an ethnic group), and identity CSE (connection or identification with one's ethnic group). The collective self-esteem scale looks at individuals and their social groups. Social groups can relate to an individual's identities (e.g, gender, race, religion, ethnicity, nationality, and socioeconomic class).

The study's objective is to provide further research on adult interracial friendships. The outcomes of this study will potentially have positive influences on the adults in interracial friendships. For example, increasing an individual(s) and cultural competence would positively influence by learning something they did not know before that friendship. The research question that we want to answer is whether interracial companies increase ethnic identity and psychological well-being (i.e., open-mindedness and self-esteem).

Methods

Participants

Participants in the study were 330 southern California university students. The percentage of the ethnicity or race of the participants was 58% Latinx, 14% Asian, 7% White, 2% African American, and 18.3% other/multiracial. In addition, the institution from which data was collected is a Hispanic serving university. Our decision in choosing which university to collect data from was primarily due to the diverse student population. This allows for a higher chance for individuals to have ethnically diverse friends and allow us to assess interracial friends. Participants identified predominantly as Women (N=289), Men (N=40), and non-binary (N=5).

Measures

The measures used in the survey were presented as open-response and close-response questions. The open-response and were related to self-reported responses given by the participants. These questions related to participant demographics such as identifying their gender, sexual orientation, age, and racial or ethnic identity.
Open-ended questions were also used to answer questions related to their closest friends (e.g., quantity and identities of their friends). To assess friendship quantity, participants were first asked, "How many friends do you have?" In addition, "Among these close friends, how many are from a different racial or ethnic background than you?"They were then asked, "Among these close friends, what ethnic or racial groups do you think they identify as African American, Asian, Latino/a/x, White and open, or other. Lastly, they were asked, "What is the sexual orientation of your close friend(s)?"

To assess friendship quality we used the Friendship Quality Scale: Conceptualization, Development, and Validation (Thein, Razak, Jamil, 2012). The friendship quality scale is 21 items but 10 items were used in the survey. The scale is divided into four different subscales on a four-point Likert scale ranging from strongly agree to strongly disagree. A total of The subscale was divided into four parts: friendship closeness, acceptance, helping, and safety. Average scores were calculated across the 10 items, such that a higher score indicated higher friendship quality.

Friendship Closeness T

The first subscale was related to friendship closeness. Example items include, "I always joke with my friends" and "I understand my friend's mood". Average scores were calculated and we found that the quality of interracial friendships did not have any

impact on an individual's self-esteem or collective self-esteem.

Friendship Acceptance

The second subscale that was given was related to friendship acceptance. There were a total of four items used from the friendship acceptance subscale. Example items include, "My friends and I can overcome differences in our opinion immediately", and "My relationships with my friends are like brothers and sisters". Average scores indicated that the more accepted individuals felt by their interracial friends, the higher their PSE and public CSE.

Friendship Helping

The third subscale used was related to friendship helping. There were two items derived from this subscale and incorporated into the survey. Example items include, "My friends help me to solve problems," and "My friend would help me if I needed it".

Friendship Safety

The fourth subscale used was related to friendship safety. There were a total of four items derived from this subscale and incorporated into the survey. Example items include, "I am confident that my friends will not leak my secret" and "My friends never break a promise". Average scores showed that the more safe individuals felt with their interracial friends, had a positive impact on their private CSE.

Personal Self-esteem

To assess personal self-esteem, the Rosenberg (1965) self-esteem scale was used. This was a 10-item scale and responses were organized on a 5-point Likert scale, ranging from strongly disagree to strongly agree. A total of 10 items were used in the survey. Example items include: "I feel that I am a person of worth, at least on an equal basis with others" and "I feel that I have a number of good qualities". Average scores were calculated across the 10 items, such that a higher score indicates greater personal self-esteem.

Collective Self Esteem

To assess CSE, we used the Luhtanen and Crocker (1992) CSE scale that looks at an individual's social identity (i.e. ethnic identity). The CSE is a 16-item scale and is assessed on a 7-point Likert scale ranging from strongly disagree to strongly agree. All 16 items were used on the survey to look at an individual's CSE. The scale was divided into 4 subscales: Private CSE, Public CSE, Identity CSE, and Membership CSE. Average scores were calculated across the 16-items such that a higher score indicated greater collective self-esteem.

The first subscale used looked at Membership CSE. Four items were created for this scale and all four were used in the survey. Questions related to how individuals felt about being a member of their ethnic group (i.e. worthiness). Example items included were,

"I am a worthy member of the ethnic group I belong to," and "I feel I don't have much to offer to the ethnic group I belong to".

The second subscale used was related to Private CSE. Four items were developed for this subscale and all four items were used in the distributed survey. Questions related to Private CSE looked at how an individual perceives their ethnic group. Example items include, "I often regret that I am a member of my ethnic group", and "In general, I am glad to be a member of the ethnic group I belong to".

The third subscale used was related to Public CSE. Four items were developed for this subscale and all were used in the survey. Questions related to how individuals thought other people viewed their ethnic group. Example items include, " Overall, my ethnic group is considered good by others," and "Most people consider my ethnic group, on average, to be less effective than other ethnic groups".

The fourth subscale used was related to Identity CSE. Four items were created for this subscale and all items were used in the survey. Questions related to how important an individual's ethnic group was to them as a person. Example items include: "The ethnic group I belong to is an important reflection of who I am" and "The ethnic group I belong to is unimportant to my sense of what kind of a person I am".

Demographics

Some of the other open-ended questions that were asked were related to the demographics of the participants. Participants were asked. "What was their gender?". The responses included 4 items: male, female, non-binary, and open (i.e. participants fill in what their gender identity is). Next, participants were asked, "What is your sexual orientation?". This question was an open response for participants to answer. Next, they were asked, "What is your age?", which was an open response. Lastly, participants were asked what their ethnicity was and were told to check all that apply. They were given seven options: Asian or Asian American, Black or African American, Hispanic or Latinx, White/Caucasian/Anglo/European American, American Indian/Native American, Native Hawai'ian or Pacific Islander, and open response.

Procedures

Surveys were administered during the Spring Semester at a Southern California University of undergraduate students in the Psychology Department. The following materials were used to collect data in the Fall Semester. First, we submitted our study to the Institutional Review Board for approval to conduct the study. Then, we used the Statistical Package for the Social Sciences (SPSS) to conduct further investigations. Next, we used the Qualtrics database to create our surveys. Finally, we used the Sona system (e.g. the university's database for distributing surveys to students) to complete and administer our survey and consent forms online.

In this study, participants followed a series of three steps. First, informed consent forms. The consent form will give participants an idea of how the study is being conducted

Results

Figures

Correlation results found that the number of interracial friendships was not related to PSE (personal self-esteem) but was significantly correlated with decreases in private and identity CSE. In contrast, the quality of friendship was significantly related to increased PSE and membership, private and public CSE. Multiple regression results show that the variance in identity CSE, R^2 = .072, $F_{(5, 321)}$ = 5.331, $p < .001$. Results show that the greater percentage of interracial friendship predict a significant decrease in Identity CSE, B = -.660, SE = .145, $p < .001$ and Private CSE, B=-0.392, SE= .108, $p<.01$ (see table 1). Results show that the quality of interracial frienship (i.e. friendship acceptance) predict a significant increase in personal self-esteem, B= 0.332, SE=0.148, $p<.05$ as well as Public CSE B= 0.318, SE=0.147, $p<.01$. Results show that the quality of interracial friendships when it came ot friednshio safety predicts an increase in Private CSE, B=0.266, SE= .091, $p<.01$.

Table 1. Multiple Regression Analysis Results (N=334)

	Personal Self-esteem		Identity CSE		Public CSE		Private CSE		Membership CSE	
	B	SE	B	SE	B	SE	B	SE	B	SE
Intercept	1.798	0.409	3.502	0.448	2.262	0.407	3.729	0.334	2.509	0.449
Interracial friendship %	0.075	0.133	-.660**	0.145	-0.249+	0.132	-0.329**	0.108	-0.216	0.145
Friendship Closeness	-0.014	0.154	0.263	0.169	-0.199	0.153	0.029	0.126	0.054	0.169
Friendship Acceptance	0.332*	0.148	-0.233	0.162	0.318*	0.147	-0.095	0.121	0.305	0.162
Friendship Helping	0.162	0.122	0.06	0.133	0.161	0.121	0.035	0.099	-0.132	0.133
Friendship Safety	0.062	0.112	0.133	0.123	0.083	0.111	0.266**	0.091	0.138	0.123
R2	0.081+		.077**		0.065		0.072***		0.044*	

+p<.10, *p<.05, **p<.01, ***p<.001

*The more interracial friends participants had, the more likely they may view their ethnic group (Private CSE) and the less connected they may feel with their ethnic group (Identity CSE). Regarding the quality of interracial friendships, our hypothesis was partially supported. The more accepted individuals felt with their interracial friends the more likely they

Discussion

Based on our results and previous findings, there is a level of understanding of the importance of having interracial friends. This study shows the importance of exposure to different cultures and ethnicities on how individuals may develop such relationships later in life. It is important to also take into account the individuals that might be surrounded predominantly by individuals that identify the same as them in terms of ethnicity or race. This means that they will not have exposure or a level of understanding of the importance of diverse relationships. That is why people need to be taught early on in high school and continue throughout college. In a continuously growing society, it is more common to interact with those that may look different than us, and knowing how to interact with them can help in the future. For instance, in one's workplace, it is more common that individuals will be interacting with those that are from a different racial or ethnic background than their own.

While this study focused on ethnic or racial differences, there are also gender differences that have also been researched. Gilliespie (2015) focused on gender similarities in the amount of same or cross-gender friendships an individual had. In addition to the importance of close friends as it relates to life satisfaction. Gillespie (2015) found that both men and women had more friends that were of the same gender as them. With that, they found that those that had more same-gender friends were more satisfied than those that didn't.

What we could have done differently in the study is to collect qualitative study rather than quantitative. In quantitative data, the concern is usually how many participant responses we have received to find commonalities in the variables that we are looking at. For example, if more participants showed an increase in personal self-esteem when they felt close to their interracial friends, we could assume that overall interracial friendships are good. However, qualitative data offers a more personalized explanation of the results. It doesn't focus on the number of responses but instead explains the trends in responses.

Another limitation that we had was in the friendship quality scale. Although the scale we used encompassed some of the important qualities that make up a strong platonic relationship, it does not factor in what the participants value most in a relationship. Some people may consider time or common interests as other components that can contribute to their friendships. For the future, maybe adding a few categories or maybe recreating the friendship quality scale might be helpful. Or maybe ask participants three things they value most in a friendship and why and then proceed to provide the friendship quality scale.

Findings/Potential Direction of research

We hypothesized that the quality and quantity of interracial friends would positively impact an individual's personal and collective self-esteem. The hypothesis was not supported when looking at the quality of interracial friendships, those that feel accepted and safe with their interracial friends do get the most out of their relationships. Participants that felt accepted had an increase in PSE and Public CSE. Those that felt safe with their interracial friend(s) had increased Private CSE. While it shows the importance of the quality of interracial friendships, it shows that not all of the components on the scale (e.g., closeness and trust) do not matter as much in this case.

The results may have looked like this because individuals may be overwhelmed by cultural differences and find comfort in similarities found in their friendships (e.g., same ethnic identities). Due to this, individuals might be afraid of being judged by people

different from them. Some ways that allow individuals to approach such relationships with more confidence relate to teaching them about interracial relationships. Schools can host workshops or programs to help students learn about developing meaningful relationships in the future. Creating programs or workshops that inform individuals at a young age how to engage with individuals that are from a different ethnic background. In these workshops, individuals must engage in conversations that allow respect for perspectives and opinions. The results show that there should be more discussion about balancing the amount and quality of interracial friendships. It can be assumed that the diversity in experiences and culture can produce insecurities in those that have interracial friends. Being surrounded by more friends that are different from you can be overwhelming.

Moreover, providing resources in schools or after-school programs that encourage discussion about ethnicity and how it impacts an individual's life. To add, students can participate in clubs or organizations that relate to their ethnic group (e.g., Black Student Union). Overall, practicing a safe space environment could allow individuals to take that into the real world. The intention is that if a student is familiar with having open conversations while actively listening and respecting others, this may allow for them to do the same when having conversations with their interracial friends. In addition, individuals can speak up about how they feel about being a member of their ethnic group. People are not always taught about their culture and that might also cause discomfort. Engaging in conversations where the individual feels like they are in a safe space to speak about their experiences as being a member of their community, while also listening to their peers discuss reduces the number of interracial friends that they hang out with within one sitting, as they might feel outnumbered or vulnerable in certain situations.

While our study contributes to the lack of research on interracial friends, it does not look at other components that may contribute to a difference in the number of interracial friends an individual has. Age can play a factor in how many interracial friends an individual has or impact on PSE or CSE as a whole. In comparison to the 1960s versus now in 2022, the perspective of interracial relationships was different. In the 1960s, people were ridiculed for having friends from a diverse racial or ethnic background than their own. However, in 2022 forming such relationships is more normalized. The generational perspective could contribute to different results that were not considered in this study. Future studies may want to look at the generational differences when it comes to the number of interracial friends one has and the quality of those friendships.

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Camacho Andres

Breeding Organic Tomatoes

Abstract

The genetic improvement of organic tomatoes is pertinent due to high nutritional value and as the organic market strives, conventional cultivars perform poorly in low input conditions. The current project is focusing on the development of organic tomato breeding populations through cycles of hybridization and selection in the greenhouse and field, respectively at Cal Poly Pomona (CPP). The superior parents were hybridized in all possible combinations and progenies were subjected to the selection at certified organic field, Spadra Farm, CPP. In February 2022, thirty-one organic tomato breeding lines, alongside commercial lines as control, were seeded in the Greenhouse, Agriscapes, CPP. Seedlings were transplanted in the field, while others were maintained in the greenhouse for hybridization. During summer 2022, data collection, weeding, and irrigation practices were carried out. As the fruit matures, harvesting has been initiated where fruit quality data and total yield will be measured. The goal of the study is to improve traits including BRIX, total yield, marketable yield, etc., and determining heritability. The analysis of data comprises ANOVA (analysis of variations), Pearson's Correlation coefficient, and Regression. The measurement of fruit quality includes color, texture, scarring, blossom end rot, sunscald, cracking, and ripening. Identifying highly heritable traits and selecting plants with superior fruit qualities will further enhance the performances of the tomato lines, ultimately leading to a superior, distinct, and higher performing tomato breeding populations which could produce marketable lines for organic production. To achieve the desired goals, analytical comparison of the tomato lines based on their performances will be highly informative in addition to assessing the effect of environment and genetics.

INTRODUCTION

Tomatoes are an important factor to the human diet and are grown worldwide, taking up large amounts of land at an estimate of 4.98 million hectare (Mubarok, et al., 2015). According to the most recent Food and Agriculture Organization (FAO) data, during the past 60 years, tomato output has increased internationally, with 5.03 million plants annually producing roughly 180.8 million tons of tomato fruits (Meng, et al., 2022). While the average global yield of tomatoes per hectare climbed greatly from 1999 to 2009 and remained steady from 2009 to 2019, the harvested area and global tomato production both increased significantly over the same time period (Meng, et al., 2022). California is recognized as the state with the largest tomato production in the United States. About 12.6 million tons of tomatoes were produced by Californian farmers in 2018, making it the crop with the largest amount of production in the state (Smith 2020). In fact, California produces more than 30% of the world's total tomato crop and almost 96% of the processed tomatoes produced in the United States. As a result, the Californian tomato processing industry, with a market value roughly $1 billion USD, is a substantial economic engine (Vidyarthi and Simmons, 2020). Tomatoes are utilized in the US for development of products and recipes such as canned tomato soups, ketchup, chili sauce, juice, paste, powder, puree, salad dressings, and sauces (Razdan, et al., 2006). With tomatoes experiencing a fluctuation in amounts as of 2020, there are high demands for organic tomatoes (USDA, 2021; Mubarok, et al., 2015).

Organic tomatoes are rich in vitamin C, minerals, and antioxidant lycopene (Aubrey 2013). Organic tomato qualities, that includes: marketable appearances, firmness, colors, and their beneficial nutrition are valued as important factors to consumers in markets and industries (Mubarok, et al., 2015). Organic farming offers control of pest management, reducing/avoiding soil erosion, improvements in soil contents, sustainable water amounts, handling of weeds, and use of organic fertilizer (Campanelli, et al., 2015). There is now a primary approach that focuses on genetically improving organic tomatoes through the emergence of breeding programs (Campanelli, et al., 2015). The use of breeding techniques by breeding programs for organic farming influences the stability, production, and overall shelf life of tomatoes, which benefits not just the dietary source for consumers, but also makes the fruits marketable (Mubarok, et al., 2015).

This methodology is centered in enhancing fruit qualities and adaptations to certain environmental and climatic conditions. Breeding technique, like crosses being made between different tomato lines, increases variations within breeding populations in order to select desired traits and to analyze the interaction between their genotypes and the location of these tomato plants (Campanelli, et al., 2015). As a result, selection of superior lines, phenotyping, observing abundance of tomato contents, and analysis of genomes will all play a vital role for future tomato cultivars (Schauer, et al., 2006). Thus, increasing agrobiodiversity among the varieties of new tomato populations in their own microclimates and environment (Campanelli, et al., 2015).

The objective of this project is to develop breeding populations through effective breeding techniques to evaluate superior tomato lines based on its measurable traits. Diallele mating scheme was used to perform hybridization between the lines in all possible combinations. Hybridization is a method used to breed two genetically diverse parental plants that results in genetic recombination and creating variations in the progenies for the traits such as fruit quality, sugar/acid content, total/marketable yield, etc. The project was conducted under low input and Southern California climate at certified organic, Spadra Farm, CPP, where selections of superior lines were made for most adaptable and higher yielding lines. Such practices grant the opportunity to determine heritability of desired traits and production of superior lines for the cultivar production. Since the beginning of the Plant Breeding Research Program at CPP, cycles of selection and hybridization have continuously occurred leading to the production of genetically improved tomato lines.

METHODOLOGY

Thirty-one organic tomato breeding lines, including commercial lines as control, were seeded in the Greenhouse, Agriscapes, CPP, in seedling trays. The organic potting mix and organic fertilizer were utilized for the seeding and facilitating germination since February 2022. The seedlings were monitored daily and once well-developed roots were present, transplanting took place at Spadra Farm. Proper setups were carried out prior to transplanting such as: irrigation line/grip setup, stakes installation, and weeding. To maintain the tomato plants in the field, maintenance was carried out such as, weeding, irrigation, trellis line set up (keeps plants elevated), and irrigation line repair if there were any leaks. An irrigation schedule was established where the tomato lines are watered twice a week.

There are a total of three harvests (early, middle, and late period) that will be carried out. Plants with clusters of fully ripened tomatoes will be harvested for data and seed collection. The following data that were examined includes traits such as total yield, marketable yield, sugar/acid content, blossom end rots, and fruit quality. For total yield, a weight scale is utilized to measure the weight of all tomatoes harvested for each plot from each row in grams. Non-marketable tomatoes with signs of blemishing, diseases, blossom end rot, sun scalding, scarring, and cracking are eliminated from the collection and good quality tomatoes are kept which aids in measuring marketable yield in grams. BRIX data determines sugar/acid content that is measured through a digital refractometer by poking a hole through all five tomatoes kept, and squeezing the juice onto the reader of the device itself that will display the value. Blossom end rot is determined through a scoring of 1-3 where, 1 indicates 15% or less of the harvested tomatoes having blossom end rot, 2 being 15%-50%, and 3 being 50% or more. Correlation will also be calculated in order to determine the effect BRIX data may share with blossom end rot. Broad sense heritability (H) will be calculated in R studio (2022.07.1 build 554) and lme4 (linear mixed effect models using 'Eigen' and S4 version 1.1-28), as well as emmeans (estimated margin means version 1.7.2.). Last, overall fruit quality aids in determining which lines produces the best marketable tomato from this experiment through estimated observations, scoring them from 1-3, 1 being the best and 3 the worst.

Another group of tomato lines were seeded at the greenhouse that were transplanted into pots once fully grown. These plants were utilized to perform crossing, following a diallel mating scheme. Two parent plants are selected for crossing where the first plant is emasculated by removal of anthers, sepals, and petals, leaving the stigma exposed and preventing self-pollination. The second plant is used to collect pollen from a fully bloomed flower. An electric toothbrush is used to cause vibration on the flower when pressed on, allowing pollen to be released, which gets collected through a capsule. The next procedure is followed by dipping the stigma of the emasculated flower onto the capsule with pollen, allowing fertilization to occur. Records of crosses are kept through labels and a tomato crossing log. Tomatoes grown as a result of the crossing, are kept for seed collection. Same steps are repeated with other plants in the greenhouse.

RESULTS
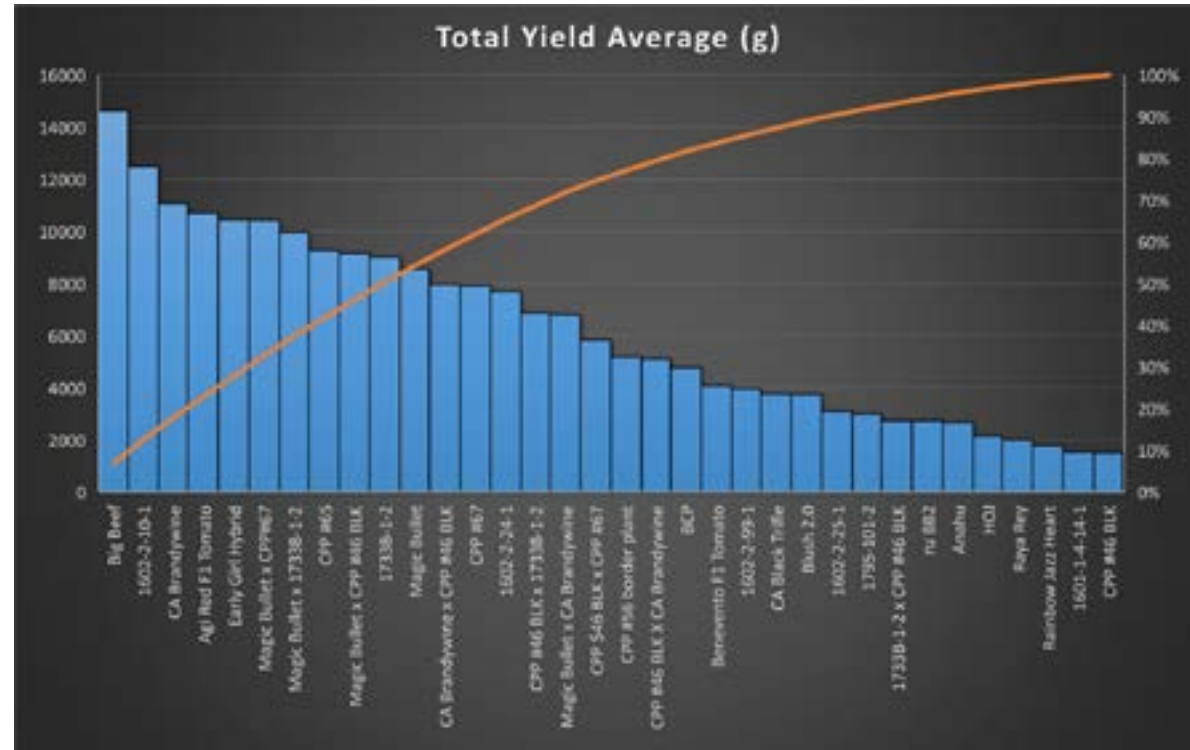
Figure 1. Average total yield (g) of thirty-four organic tomato lines at CPP.
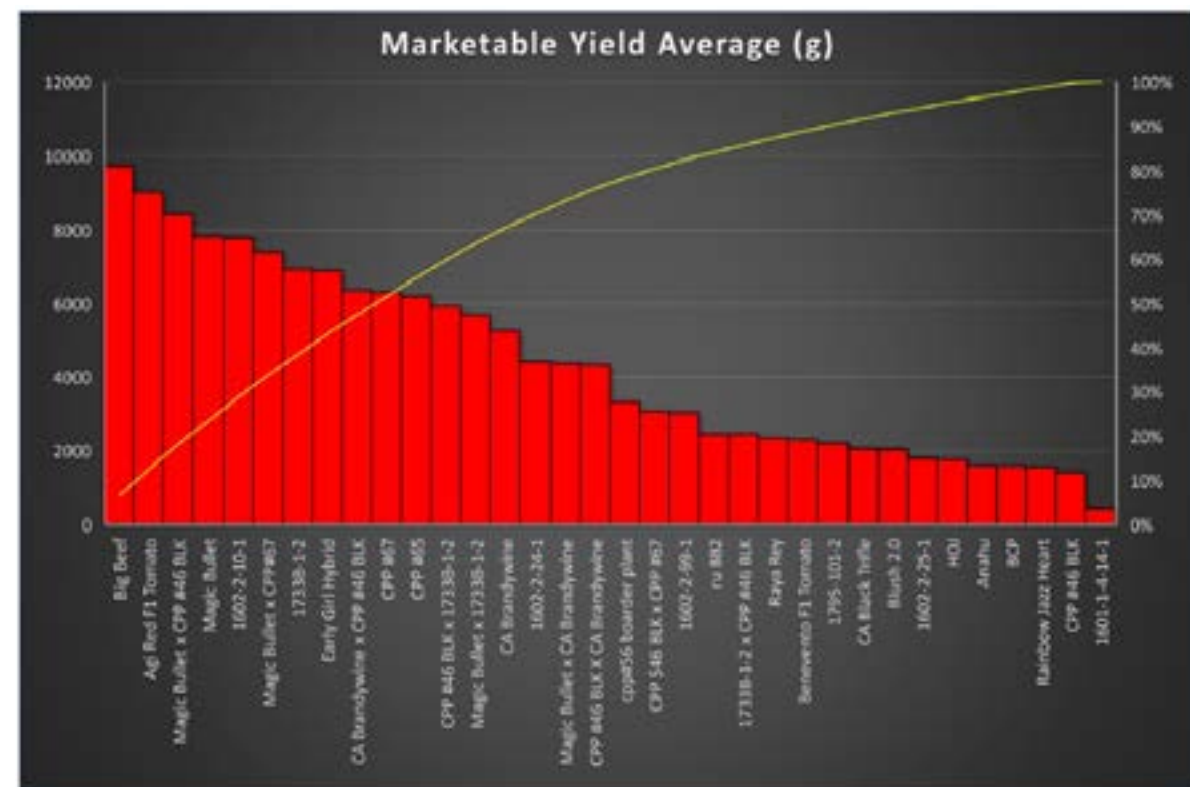
Figure 2. Average marketable yield (g) of thirty-four organic tomato lines at CPP.
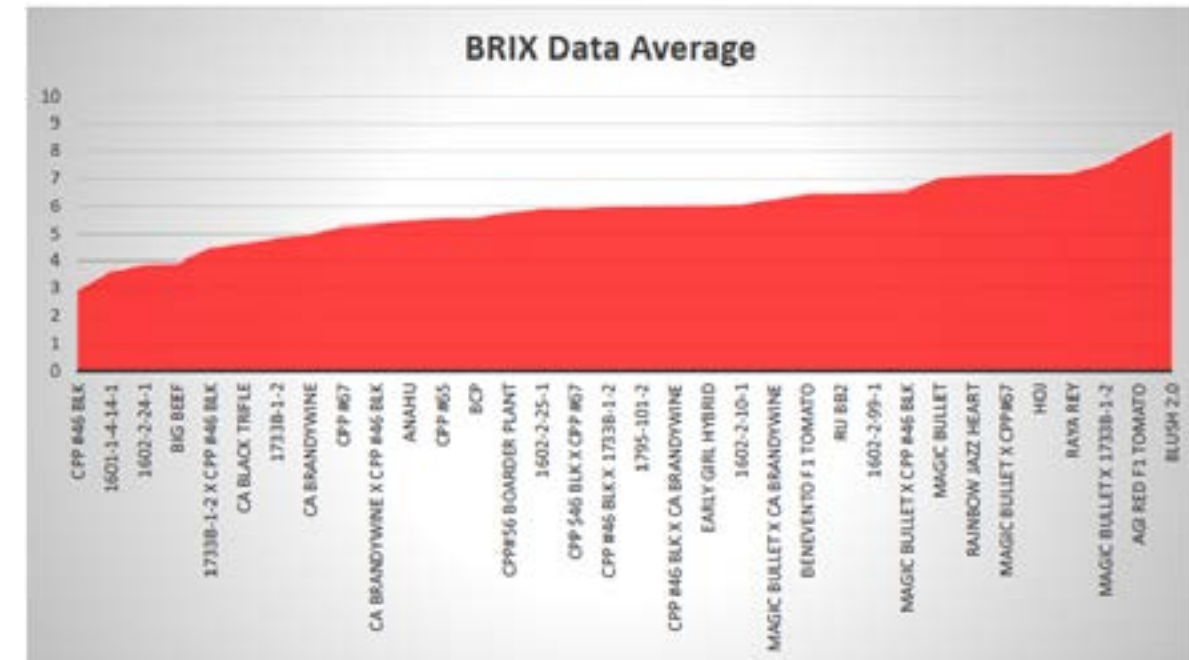
Figure 3. Average BRIX data from digital refractometer of thirty-four organic tomato lines at CPP.
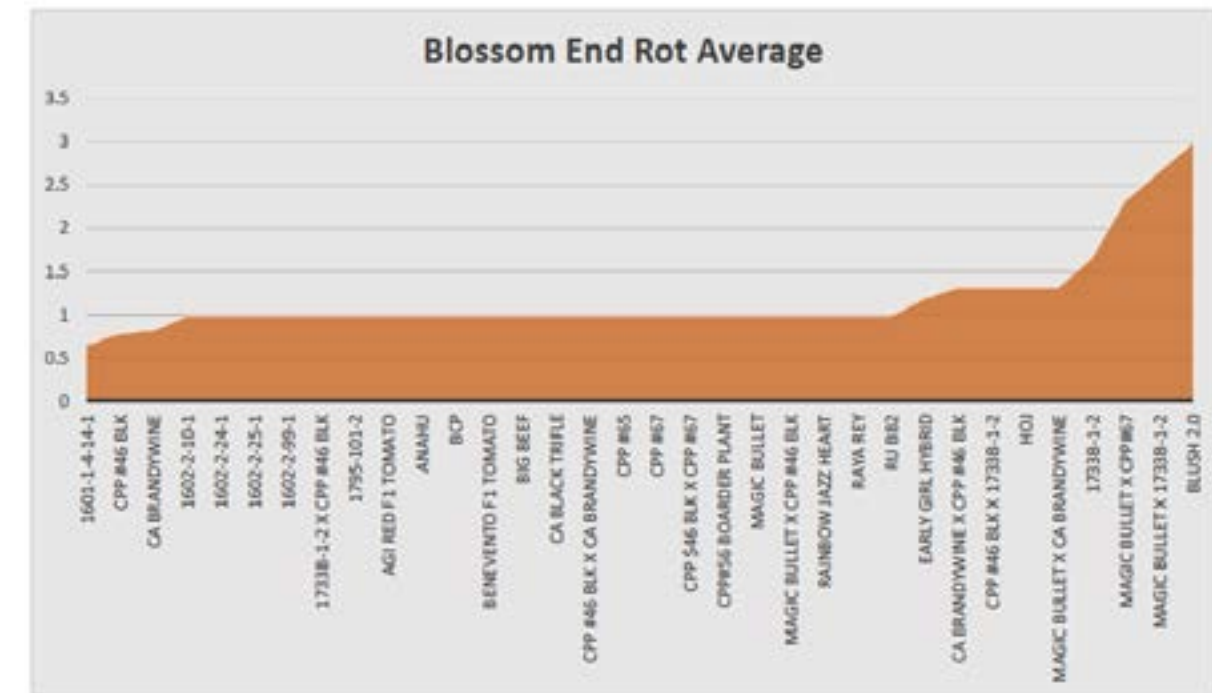
Figure 4. Blossom end rot average of thirty-four organic tomato lines at CPP.

The following results are from total yield, marketable yield, BRIX, blossom end rot, and fruit quality data collected in the first harvest (early period), where the average was calculated to produce charts. Looking at figure 1, Big Beef was the line with the highest total yield, or in other words, produces the most tomatoes. When looking at other lines, crosses like Magic Bullet x CPP #46 Black, Magic Bullet x 1733B-1-2, and Magic Bullet x CPP #67 were in the top ten for total yield as well. Figure 2 displays the Marketable Yield Average where Big Beef also consist of the highest marketable yield. Crosses such as: CA Brandywine x CPP #46 Black, Magic Bullet x CPP #67, and Magic Bullet x CPP #46 Black were a part of the top ten tomato lines with high marketable yield. Comparing lines in total and marketable yield is essential because these data provides an understanding of which area needs to be improved, whether it's increasing yield, improving qualities, and/or both.

Figure 3 shows that Blush 2.0 is the line possessing the highest BRIX value or in other words, consist of high sugar and acid content. When observing the top ten lines, Magic Bullet x CPP #46 Black, Magic Bullet x CPP #67, and Magic Bullet x 1733B-1-2 are crosses with high BRIX values as well. Blush 2.0 also ranked the highest with blossom end rot in figure 4 including CA Brandywine x CPP #46 Black, CPP #46 Black x 1733B-1-2, Magic Bullet x CA Brandywine, Magic Bullet x CPP #67, and Magic Bullet x 1733B-1-2 all top ten lines with high abundance of blossom end rot. A correlation was calculated and results show that BRIX data and blossom end rot have a high correlation of 0.715. Broad sense heritability was calculated and resulted in BRIX having a value of 0.849 and blossom end rot with a value of 0.866. This indicates that both traits are indeed, heritable amongst many lines.

Figure 5 shows overall fruit quality for each line and Blush 2.0 had the worst quality. On the other hand, CA Brandywine x CPP #46 Black was the line with the best quality in this experiment.

CONCLUSION

This study allowed genetic variation of tomatoes to be observed and analyzed which aids in differentiating each line, in order for selection of superior lines to be made. Observing traits such as total yield, marketable yield, sugar/acid content, blossom end rot, and fruit quality granted the opportunity to determine which lines performed best under low inputs at Spadra Farm. These sets of data are essential in determining heritability amongst the lines and traits such as sugar/acid content (BRIX) and blossom end rots are example of traits that are heritable with a broad sense heritability of 0.849 (BRIX) and 0.866 (blossom end rot). Crosses also performed well and were part of the top ten lines for every traits observed. These findings are an important factor in looking for other ways to improve fruit quality and increase total yield for each line. Given that this was the first harvest, the data that were collected are essential in understanding how the organic tomato lines have been performing since transplanting and further harvesting will show how they continue to adapt in their own microclimates under certain conditions.

Figure 5. Fruit quality average of thirty-three organic tomato lines at CPP.

FUTURE WORKS

Since this experiment is ongoing, further hybridization between parent plants will continue to occur in order to produce many F1 generations of crosses and evaluate them based on traits. Superior lines that were selected will be utilized in order to produce all possible progenies and analyze their performance at Spadra Farm. The seeds that were collected during the seed collection process will also be used when beginning the next experiment. Furthermore, tomatoes that performed poorly will be re-evaluated in order to improve quality and yield.

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Camacho Andres

Genetic Improvements of Organic Tomatoes for Marketable Yield and Higher Fruit Quality

Abstract

Tomato is an economically important crop, which comprises of vitamins (C and K), folate, and antioxidant lycopene, providing many benefits to consumers. The project is designed to genetically improve tomato traits for yield and fruit quality such as firmness, limiting physical blemishes, sugar contents, and acid contents. The phenotyping of the tomato lines was performed, and superior inbred lines and individual plants were selected, which showed higher fruit quality and yield, including marketable yield. Since the beginning of the Plant Breeding Program at CPP, hybridization of inbred lines with genetic variations leads to the development of new tomato lines with improved traits. Twenty breeding lines of organic tomatoes were planted in certified organic field, Spadra Farm, CPP in a randomized complete block design with two replications, in Spring 2021. Lines were evaluated on traits: plant height, total yield, canopy density, sugar and acid contents. Six superior lines were selected for the next generation selection cycle and hybridization. ANOVA (analysis of variation) and multiple comparisons were conducted to analyze the data and compare the performances of the tomato lines. Results from the analysis were used to finalize the selection for hybrid parent lines.

INTRODUCTION

Tomatoes are a major dietary source due to its richness in minerals, vitamins, antioxidant lycopene, and certain organic acids (Garg, et al., 2007). Tomato production in the United States is the highest in California. In 2017, 12.7 million tons of tomatoes were grown in the United States for ketchup, pasta sauce, or canned tomato products and 95% of all production occurred in California. In the last 20 years, US markets for organic produce have experienced a double-digit growth increase (Healy et al., 2017). Local food sales have increased for the US by $1 billion in 2005 to US $6.1 billion in 2012 (USDA-ERS, 2015). Demand for organic products is partially driven by the acceptance that organically grown products are healthier and more nutritious than conventionally grown products (Lammerts van Bueren, 2011; Lotter, 2003). Organic farming systems have focused on optimizing agronomic approaches for the last 40 years. There is now a greater focus shifting to the optimizing of genetic improvements to enhanced yield stability under low-input conditions (Lammerts van Bueren, 2011). A solution to low yields in organic agriculture is organizing breeding programs to directly select varieties grown in low input organic systems specifically adapted to the local microclimate (Campanelli et al., 2015; Murphy et al., 2007; Wolfe et al., 2008;). Desirable traits are expressed under low-input conditions that characterize organic systems because it is the only way to guarantee appropriate selection of desired traits (Hoagland et al., 2015; Lammerts van Bueren et al., 2011).

Tomatoes bred for uniform ripening, high yield, and disease resistance often lack fresh eating and the nutritional quality customers prefer (Powell et al., 2012). Tomatoes are highly self-pollinated, and seeds can easily propagate as pure lines (Lammerts van Bueren, 2011). Organic agriculture is considered the most sustainable low input model as an alternative to the inherent adverse association with chemicals in the agricultural system.

Such agricultural method adhere to the principles of; integrated pest management; rotation of cropping systems to minimize weeds, disease and insect populations; minimizing soil erosion, reducing water loss; the use of organic fertilizers and green manures (Healy et al., 2017; Campanelli et al., 2015; Shaver, 2003). The principles of organic agriculture are centered on maintaining a sustainable biodiversity within local ecosystems, and greater integration of crop and livestock production systems (Lammerts van Bueren, 2011; Mader et al., 2002).

The goal of the Organic Plant Breeding Program at Cal Poly Pomona is to develop superior hybrids and uniform, distinct open-pollinated populations to produce superior tomato lines that have potential to thrive in a low-input organic environment. Such germplasm will be bred at Spadra farm, CPP for fresh market and/or processing tomatoes.

MATERIALS AND METHODS

Twenty-five breeding lines (including check lines) were seeded in the seedling trays with organic potting mix soil and perlite in January 2021, at the organic section of the greenhouse, CPP. The seedling trays were maintained in the greenhouse for the seed germination and proper seedling growth. The fully grown seedlings were maintained until the roots were properly established and ready for transplanting at certified organic field, Spadra Farm, CPP. The field was irrigated once-twice a week through drip irrigation, to maintain the proper moisture content at root level, since the transplanting. The weeds were removed manually to reduce the competition of plants with weeds for the nutrients. The matured/ripened tomato fruits harvested from the tomato lines were evaluated for the fruit quality and yield. The seeds were harvested from the tomato fruits using fermentation method. For measuring plant height, a measuring tape was used to measure by feet (converted to centimeters) in order to score them into categories of height. Under two feet is a score of 1, two to four feet is a score of 2, and over four feet is a score of 3. For the total yield, harvested tomatoes were weighed by grams from each line. The results of total yield will aid in determining the marketable yield by eliminating the non-marketable tomatoes such as diseased, blemished, or unripened.

Fruit quality and canopy density were scored based on visual ratings, which are based on ranking, 1-3 (1 being a poor score and 3 the best). For fruit quality the overall appearance determines its marketability, which is based on the scores, 1-3 (score 3 is very good/marketable, score 2 good, and 1 would be poor-fair/not marketable). The Canopy density was assessed by the amount of fruit visible through the canopy. A score of 3 would indicate the tomato being heavily covered (hard to see the fruit from top), score of 2 would mean partially exposed, and 1 would mean that it is completely exposed and easily visible. The BRIX value of tomato fruit is the measurement of total soluble solids, comprising sugars and acid content. The device, digital refractometer, was used to record the BRIX value. The device pokes a hole in the tomato fruit, using a needle, to squeeze out the juice from the fruit onto the reader of the device. The data was collected regularly during the study and analyzed using ANOVA (Analysis of Variance) using SAS software (SAS inc., 2012).

The cuttings from the six selected parents from the organic field were transplanted into pots and kept in the organic section of the greenhouse for the hybridization in diallel mating scheme. When the flowers start to bloom, the hybridization will take place, which involves

emasculation of flower(s) of tomato plant (considered as parent 1) by removing the anthers and sepal, and exposing the stigma, in order to prevent self-pollination. The pollen from the other plant (parent 2) was collected using an electric toothbrush with the brush removed and the tip wrapped around a wire. The vibration of this toothbrush will allow the flowers to release pollen when pressed and were gathered using a capsule, which was labeled. This step was followed by dipping the emasculated flower onto the capsule filled with pollen, fertilizing the egg. These steps were repeated in each cross made between six parents. The crossing is completed after each cross is labeled with the parent's names and date of hybridization, in the greenhouse.

RESULTS
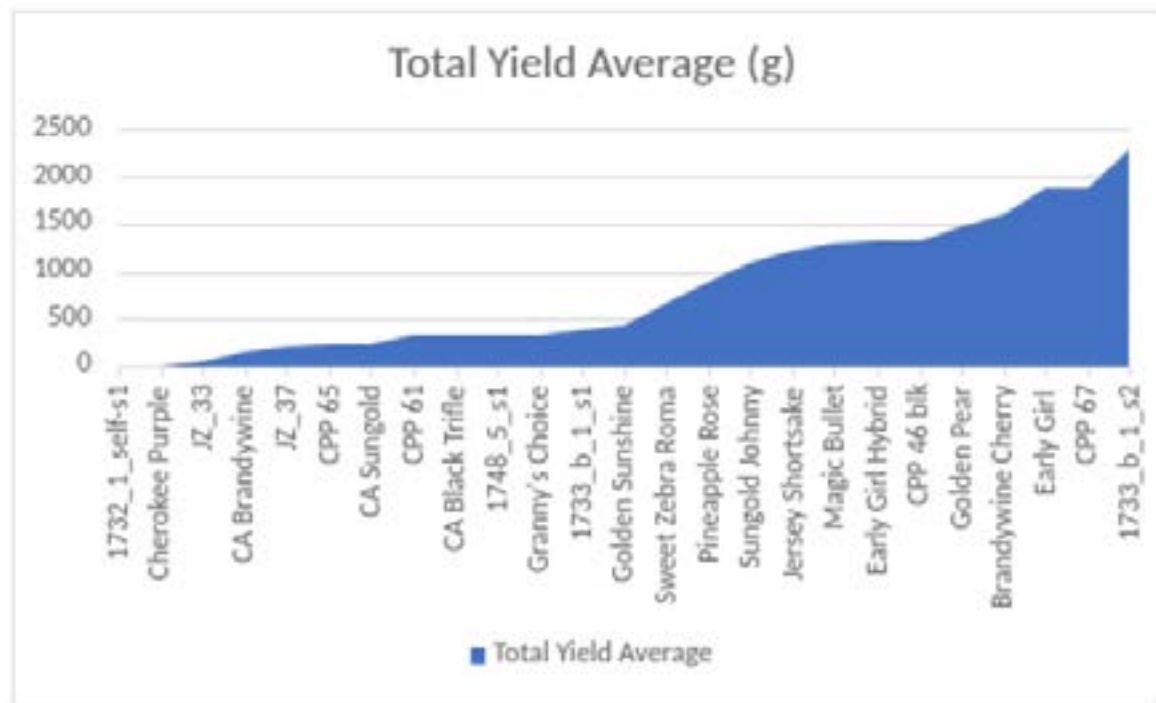
Figure 1. Average total yield (g) of twenty-five tomato lines at CPP.
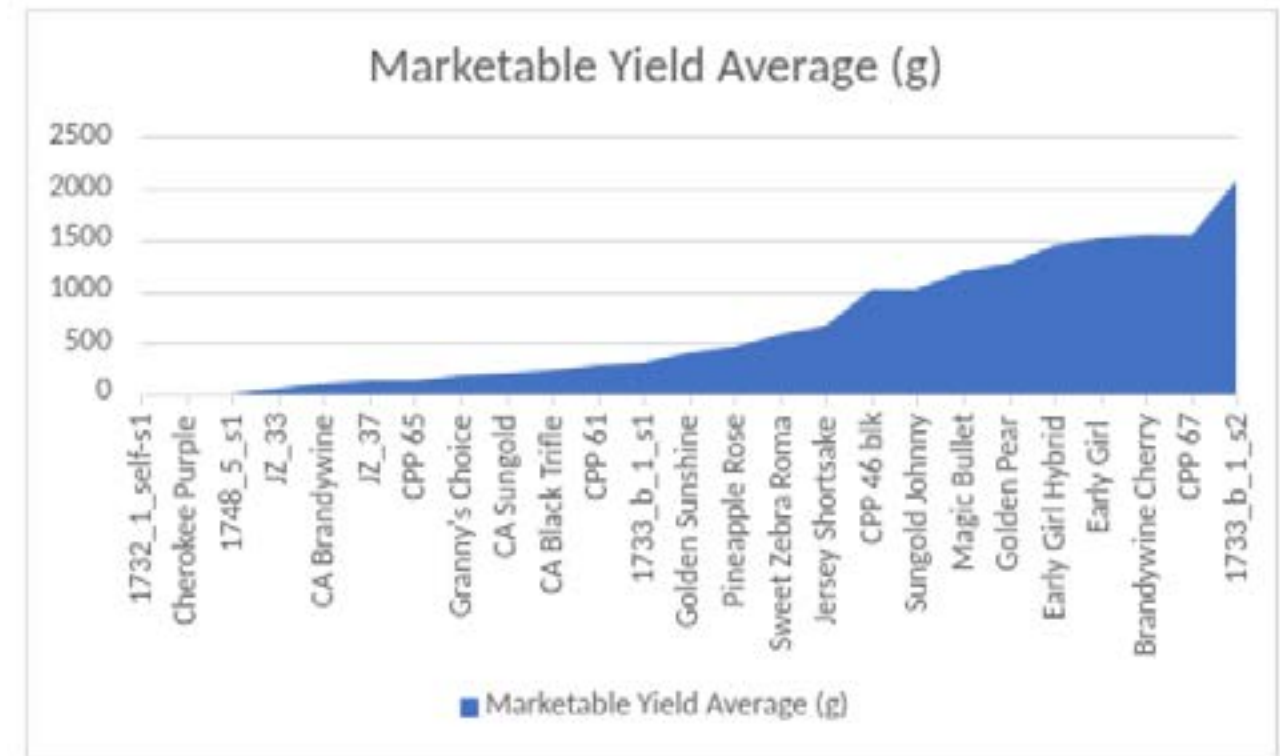
Figure 2. Average marketable yield (g) of twenty-five tomato lines at CPP.
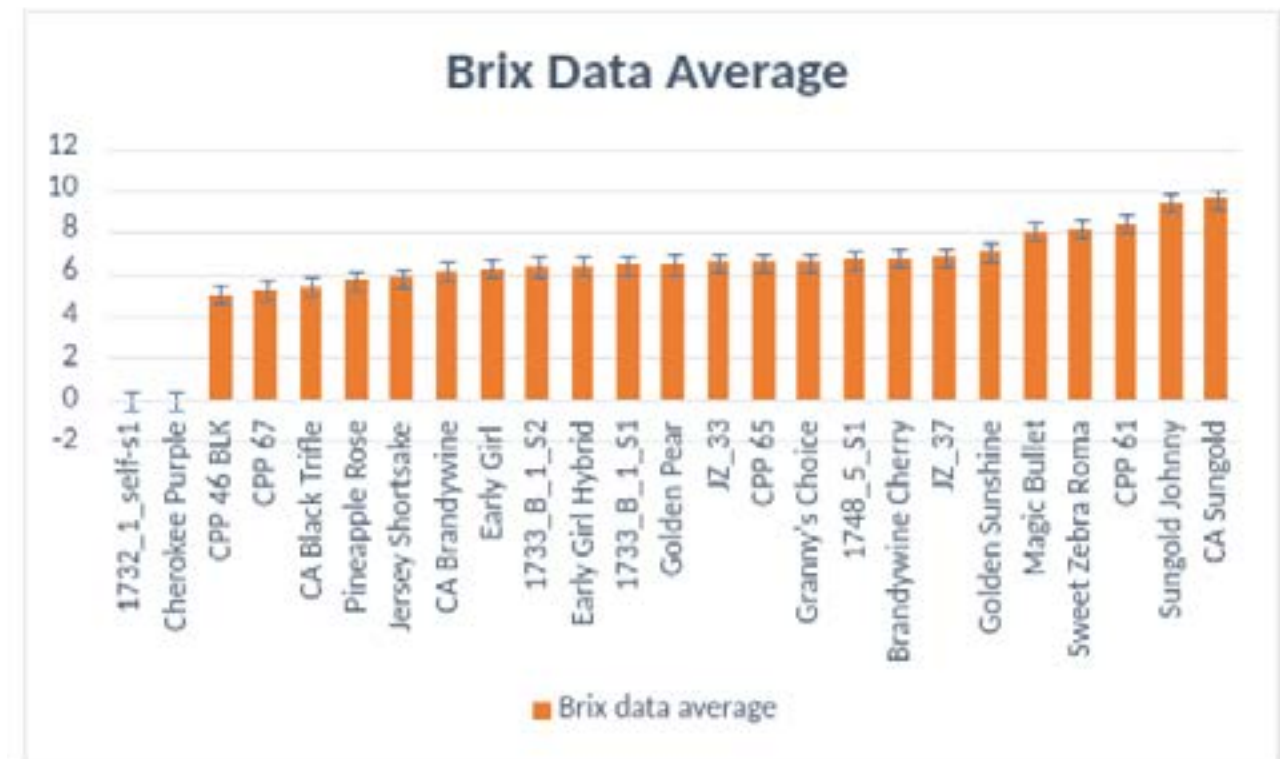
Figure 3. Average BRIX value of twenty-five tomato lines at CPP.

Figure 4. Average fruit quality of twenty-five tomato lines at CPP.
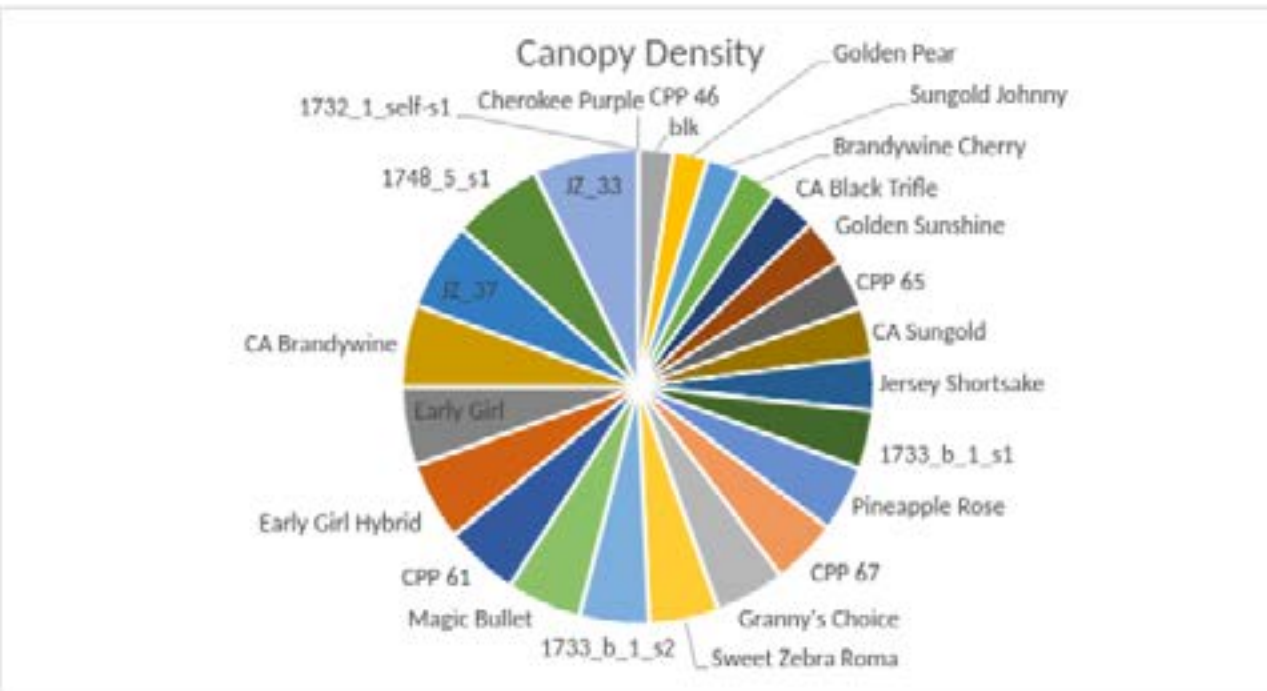
Figure 5. Average canopy density of twenty-five tomato lines at CPP.

Table 1. Average plant height of twenty-five tomato lines at CPP.

Tomato Lines	Average Plant Height (scores 1-3)
Golden Sunshine	1
CA Black Trifle	1.25
Pineapple Rose	1.33
CPP 46 blk	1.33
Brandywine Cherry	1.33
Granny's Choice	1.5
Cherokee Purple	1.67
Jersey Shortstake	2
CA Sungold	2
Golden Pear	2
CPP 61	2
1733_b_1_s2	2
CPP 65	2.2
Early Girl Hybrid	2.33
Sweet Zebra Roma	2.33
CPP 67	2.33
JZ_33	2.33
CA Brandywine	2.5
JZ_37	2.6
1733_b_1_s1	2.67
1732_1_self-s1	3
1748_5_s1	3
Early Girl	3
Magic Bullet	3
Sungold Johnny	3

The analyzed results of plant height, total yield, marketable yield, canopy density, fruit quality, and sugar/ acid content were reported in Figure 1-5 and Table 1. For the total yield, figure 1 showed the average of the yields where CPP 67 and 1733_B_1_S2 lines had the highest total yields. The highest marketable yield was shown by CPP 67 and 1733_B_1_S2 lines (Figure 2). Tomato line: 1748_5_S1 showed significantly higher total yield than its marketable yield, indicating room for improvement of marketable yield. On the other hand, line: JZ 33 showed significantly higher total and marketable yield in the study.

Figure 3 showed the BRIX value of tomato lines and CA Sungold had the significantly higher BRIX value. Inbred lines 1733_B_1_S1, Golden Pear, JZ 33, CPP 65, Granny's Choice, 1748_B_1_S1, Brandywine Cherry, JZ 37, Golden Sunshine, Magic Bullet, Sweet Zebra Roma, CPP 61, Sungold Johnny, and CA Sungold performed highly in the study. Figure 4 showed fruit quality of the tomato lines and JZ 33 performed superiorly. Figure 5 showed canopy density with line: JZ 33 performing highly in the field. In comparison to commercial lines (Early Girl), lines like JZ 33, 1748_B_1_S1, and JZ 37, were superior. Table 1 showed plant height and Sungold Johnny was the tallest tomato line in the field.

CONCLUSION

Genetic variations were observed in the study, which was essential to evaluate the tomato lines and to make selections in the field. The tomato lines were evaluated on the traits including plant height, fruit quality, and total/marketable yield, and six superior lines were selected. Most of the inbred lines such as CA Sungold, JZ 33, 1748_5_S1 performed better than most of the commercial or the check varieties: Early Girl Hybrid. With a goal to develop high performing lines, the results of data analysis provided essential information on the significant differences in the breeding lines that will help in selecting superior lines for superior fruit quality and yield. The project is continually making progress to genetically improve the tomato lines for the Southern California region. More data collection, selection, and hybridization cycles will be useful in the development of superior cultivar for the fresh market and/or processing tomatoes.

FUTURE WORK

The project will continue to evaluate agronomic, fruit quality and yield traits through cycles of selections and hybridizations under organic production conditions at CPP. The data collection process will assist in the selection methods to perform hybridization of superior lines for the development of cultivars for organic production.

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Cardenas   **Tree of Hope, Remain Strong**
Sasha

Art has the ability to express emotions and thoughts that words simply cannot at times. Artworks can play a central role in highlighting the importance of equity, social justice, and disability issues. The visual artwork, Tree of Hope, Remain Strong, was done by the Mexican painter, Frida Kahlo, in 1946. Frida Kahlo's artworks deal with the concepts of the human body and identity. As a child, Kahlo suffered from polio which left her with chronic pain and a slight limp. Later on in her life, she suffered from an almost fatal bus accident where a long metal rod pierced her midsection and underwent nearly thirty surgeries. Frida Kahlo's, Tree of Hope, Remain Strong, oil painting displays two images of Frida Kahlo. On one side of the work is the daytime with Frida's back cut open representing the injuries and impairments she suffered after her bus accident and on the right side the image shows Frida sitting confidently in the evening holding an orthopedic corset and flag saying " Tree of Hope, Remain Strong." The two images however are not entirely distinct from one another but overlap at certain points. Tree of Hope, Remain Strong by Frida Kahlo is a significant work of visual art as it grapples with the oppression of disability by revealing the meaning behind what a disability really is, displaying individuals as multifaceted, and enlightening individuals to embrace the differences amongst each other.

Tree of Hope, Remain Strong helps individuals understand what is meant by the notion of having a disability. Disability and impairment are not the same things. According to Oliver and Barnes (2010), " Disability should be distinguished from impairment and ill health and defined as the disadvantage experienced by an individual that impacts people with impairments or ill health" (p.552). Individuals can have cognitive, physical, or sensory impairments, but oppressive obstacles shape the social representation of disability. There is this common notion amongst abled-bodied individuals that individuals with impairments are the opposite of ability. This furthers the belief that individuals with impairments can not do the same activities or careers that abled-bodied individuals can. Frida Kahlo is famous for her self-portraits like her portrait of Tree of Hope, Remain Strong. These self-portraits helped Kahlo express the pain and suffering that come from being a Mexican woman artist who has physical impairments. According to a CNN article (2010) "Even more so than American culture as a whole, Latino culture values self-reliance, which can discourage people from talking about their problems." So much stigma and oppression surround individuals with impairments, especially in the Mexican community. Frida Kahlo does not let it hinder her from showcasing her disability through her art. Even though Frida Kahlo represents her disabilities in her work, her art is not always labeled as disability art. Frida Kahlo's artworks are just art. It has to be the artist's intention for their artwork to be labeled as disability art. The artwork itself guides the way the work is categorized. Society loves to categorize people and works. Frida Kahlo celebrates her disability and struggles, but she does not let them solely characterize her. She is a historical artist and icon on her own and not solely for disability arts. Frida Kahlo was one of the first female artists to go against the traditional principles of art and analyze her own mind with stories and symbols. Kahlo's creative work continues to inspire artists' imaginations all around the globe.

Tree of Hope Remain Strong, reveals how multifaceted individuals are, especially individuals with impairments. In Frida Kahlo's artwork, her two self-portraits are crossing over one another. One of her images depicts her lying on a medical bed cut open, while the other image depicts her sitting confidently on a chair. This just further emphasizes the idea that Frida Kahlo is not just her disability, she is also a strong Mexican woman. According to Goodley (2017) " Intersectionality seeks to explore convergence and divergence of multiple markers. This involves difficult conversations across socio-cultural categories and forms of interpellation to ask how, for example, disability, gender, race, sexuality, and class constitute or contradict one another"(p.89). Privileged and marginalized identities affect every aspect of how individuals perceive the world and how they are treated by the world. The stories of marginalized individuals, especially disabled and minority women, are rarely told. The media and politics tend to pass over these intersectional issues as they don't understand the multiple levels of discrimination that comes from marginalized identities. This intersectional discrimination ultimately limits the complexity of disability, while constricting the lives and controlling the bodies of people that society views as disabled, as well as restraining the creativity and imaginations of those who see themselves as abled-bodied. According to Goodley(2017) "Intersectionality can be very helpful in disentangling the highly affective vectors of differentiation that are crucial in the creation of what we perceive as our own or other people's identities, which includes the identifying attributions of disabled and abled"(p. 99). Individuals with impairments are not solely disabled. Trying to address the social oppression that encompasses disability without looking into how other identities affect the oppression only benefits a small number of people. Taking an intersectional approach to disability helps reevaluate current systems in order to aid the maximum number of people. Frida Kahlo's story is an important one as it is one that is seldomly told. Kahlo does not dismiss her disability in her work but chooses to acknowledge it while also showcasing the other sides of her. Tree of Hope, Remain Strong highlights intersectionality as individuals experience different levels of oppression or pride based on their identities.

Tree of Hope, Remain Strong is a significant work of art as it enlightens individuals to embrace the differences amongst each other. Disability is a concept that is not often discussed in education which simply continues the cycle of oppression. According to Beckett (2015) "Pedagogy 1 involves studying the Other and celebrating difference." (p.80). Students who are not disabled and are not motivated to acknowledge and confront the social oppression of disability will invariably strengthen and validate oppressive ideas and actions. Tree of Hope, Remain Strong is an excellent work of art to show in schools to help educate students to challenge the stereotypes that reinforce discrimination and internalize oppression. Students should be able to first acknowledge Kahlo as a human and artist in her own right. Commemorating Kahlo's work and achievements encourage students to celebrate human diversity and reduce the stigma of individuals with impairments as "abnormal." Individuals with impairments are not just spectators or audiences of art they can also be tremendously talented creators. Traditional education and society view disability as a biological or medical issue and not a societal one. According to Goodley (2017) " As a direct riposte to medicalized and psychologized hegemonies of disability- that sited disability as a personal tragedy, biological deficiency, and psychical trauma-disability studies relocated disability to social, cultural, economic, and political registers" (p.84). This perception of art makes individuals believe that they have no part in disability and are not effectively able to help. Disability is a social issue as the way individuals perceive and treat

individuals with impairments affect the access and respect they receive from the workforce, the art industry, and society. Tree of Hope, Remain Strong emphasizes the importance of artwork created by disabled artists to be treated and criticized through the same methods as artists without impairments.

Critics may believe that Frida Kahlo simply romanticizes her pain and suffering instead of making a significant impact on the disability community. Some individuals feel that art tends to diminish the severity of living with an impairment by portraying a form of "heroic suffering." Tree of Hope, Remain Strong doesn't do this by depicting the multiple sides that may come with having an impairment. The tone of the piece is dark but also inspiring. She showcases the harsh suffering she endured with the image of her back cut open, but also her pride in herself and her journey with the image of herself with the " Tree of Hope, Remain Strong" flag. This work of art allows viewers to feel the pain that comes with having a disability as well as educate individuals that disabled people can live successful and accomplished lives. Opponents of the value of using Tree of Hope, Remain Strong in education may assume that displaying more work from artists with impairments furthers the notion that empathy is enough to combat the oppression of disability. According to Chrysostomou and Symeonidou(2019) "[...] in an effort to develop empathy towards people with disabilities, sentimental narratives can arise promoting the charity/tragedy models of disability we aim to avoid" (p.357). In order to fully address disablism, individuals need to learn about anti-oppressive research that examines the systemic practices that exclude individuals from society and gives rise to disablism. Tree of Hope, Remain Strong can be a vital resource in the curriculum as it grapples with what society views as "normal." According to Chrysostomou and Symeonidou (2019) "Teachers should stress the way some people are being normalized and develop critical thinking skills in their students in order to take action against oppression" (p.357). In the second image of Frida Kahlo in the painting, she looks stereotypically normal, but by holding her orthopedic brace she makes the viewers reevaluate what they perceive as "normal." "Normal" should be a term that refers to everyone, even those with impairments. Students having the skills to critically analyze their involvement in oppression by examining their perceptions can help students bring about change instead of simply empathizing.

Tree of Hope, Remain Strong by Frida Kahlo is a significant work of visual art as it grapples with the oppression of disability by revealing the meaning behind what a disability really is, displaying individuals as multifaceted, and enlightening individuals to embrace the differences amongst each other. Individuals can have cognitive, physical, or sensory impairments, but oppressive obstacles shape the social representation of disability. Intersectional discrimination ultimately limits the complexity of disability, while constricting the lives and controlling the bodies of people that society views as disabled. Tree of Hope, Remain Strong is an excellent work of art to show in schools to help educate students to challenge the stereotypes that reinforce discrimination and internalize oppression. What would society be like if people viewed individuals with disabilities as equal instead of special?

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**Chavarin
Ethan**

**Introduction to NOx and Potential of N-heterocyclic Carbene
Catalysts for NOx Reduction**

The most widely discussed greenhouse gas, carbon dioxide (CO2) causes harm to our planet, however nitrogen oxides (NOx) and nitrous oxide (N2O), not only damage our home to a greater extent, but also impede the health of our population. These gases are produced by automobiles, electrical power plants, agriculture, and many other human factors.[1,2] NOx refer to a nitrogen atom connected to several oxygen atoms, but each with structural differences (Figure 1).
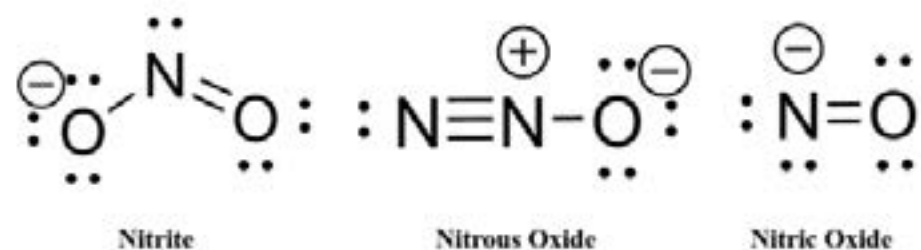
Figure 1. Three common nitrogen oxides: Nitrite, Nitrous Oxide, and Nitric Oxide.

Nitrous oxide is very stable due to the resonance effects which distribute the negative charge across both oxygen atoms. Due to the stability of N2O, the molecule can stay in the atmosphere for more than 100 years.[2] When emitted, N2O can cause more damage to our planet than CO2 because it has a global warming potential around 300 times greater than CO2.[3] One example of a resulting effect of warming is acid rain in parts of the world because of how NOx interacts with water in the atmosphere.[4] These interactions lead to the formation of nitric acid that damages our fragile ecosystems.[15]

The degradation of our surrounding environment directly affects the public, but nitrogen oxides also directly diminish the health of humans. Exposing people to NO2 concentrations that of 150 ppm or less, can severely impact their health and affect respiratory, cardiac, peripartum functionality, and death.[1,4,5,16] By exposing the public to NOx emissions and creating health complications, it creates a cycle of cycle of medical issues for the future lineage of those who are affected.

A common theme is revealed that low income and people of color (POC) communities are typically the groups of people that are exposed to high concentrations of NOx emissions.[1] Most people of color are not historically favored to be financially stable and are compelled to live in areas near hazardous facilities and factories that produce these gases.[6] As for who was there first, disadvantaged communities or these facilities is still up for debate, it does not overshadow the fact that the populace are being affected.[7] The discrimination that our country exhibits against low- income families and underrepresented cultures has created a cycle of medical and financial issues that places this group at even a greater disadvantage.

One way of potentially reducing NOx is using chemistry to design catalysts. The existence of catalytic converters has helped reduce NOx in the environment, however they are not fully 100% effective. Catalysts usually have two distinct classifications, homogenous and heterogeneous. Heterogeneous catalysts are in a different phase from the reaction mixture and are typically solids, while homogeneous catalysts are in the same phase as the reaction mixture and typically in solution. Within homogenous catalysts, N-heterocyclic carbenes are often incorporated as ligands to be able to stabilize and bind to the metal center. Due to ability of NHCs to be readily modified and the stable electronic nature, these ligands will be used in this work to make a homogenous catalyst for NOx reduction.

Typically, a N-heterocyclic carbene is a five membered ring with two nitrogen atoms on opposite sides of a 5-membered ring that contains three carbon atoms. The carbene is the carbon atom in between the two nitrogen atoms and has a set of lone pair electrons, occupying the sp2 orbital, and contains an empty p-orbital (Figure 2).[8] An advantage of NHC structures is their ability to be modified to different configurations. There are hundreds of different types of NHCs. These molecules offer a stability that is quite uncommon. This stability is due to the nitrogen atom's ability to donate a lone pair of electrons into the carbon empty p-orbital and use the high nitrogen electronegativity to pull away the electron density surrounding the carbene.[8,9] In addition to this, NHCs are able to strongly bind to metals, making them good ligands for homogeneous catalysts.[10]
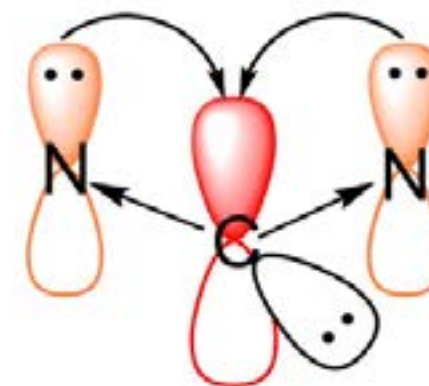
Figure 2. Arrows demonstrate the flow of electrons in the N-C-N portion of an NHC.[8]

In early studies of NHC complexes, there was a debate on whether NHC could be classified as an ylide and not a carbene. Both are very similar but differ in electronic properties. An ylide is a compound with a neutral charge however, the carbon bares a negative charge while the nitrogen substituent carries a positive charge. A carbene is a neutral carbon atom that has one lone pair of electrons and is coordinated to two substituents. NHCs are neutral and have a resonance-like form where electrons are constantly being delocalized. Through natural bond order calculations (NBO), a significant px-px delocalization from the nitrogen atoms into the empty p-orbital of the carbene was found, suggesting that 'carbene' was the most apt classification.[8,11]

A catalog of metals have been used in NHC complexes, however researchers have shifted their interests to cheaper, more abundant, first row transition metals, such as nickel, copper, and cobalt.[11] NHCligandscanalsobemonodentateormultidentate. Forexample,ifthereisoneNHC that donates one lone pair of electrons bind to the metal, then the complex would be considered monodentate (Figure 3-2). If there are two NHCs that are linked to each other such that they are able to donate two lone pairs to the metal center, then it could be classified as a bidentate (Figure 3-1). Bidentate NHC ligands are known to stabilize catalysts for a plethora of reactions such as cross coupling reactions and C-H activation.[12,13] However, there is a lack of research using bidentate NHC ligand for catalysts to reduce NOx. One study used a monodentate NHC complex to reduce carbon monoxide (CO).[14] This leaves room for the topic to be explored.
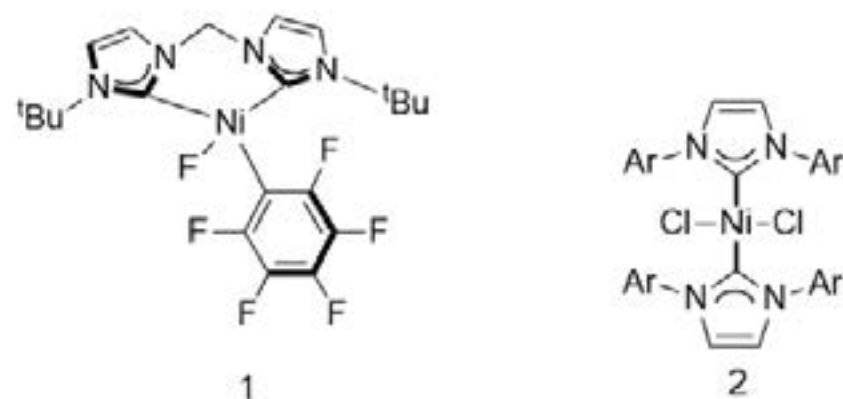
Figure 3. Two reported complexes that demonstrate the difference between a bidentate and monodentate NHC ligand. **1** is bidentate. **2** is monodentate.[17]

In summary, N-heterocyclic carbene complexes have high stability, easy accessibility, and have been demonstrated to reduce CO, which suggests they could be used to reduce NOx. Bidentate complexes are a less explored area of research and have potential to reduce NOx.

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Project Title: The Effects of Texting, Tweeting, and Internet Slang on Academic Literacy

Abstract

Young adults born at the turn of the 21st century are brought up with new modes of connecting with friends and peers online. As a result, they tend to communicate in a more informal register. This includes using informal grammar, spelling, punctuation, internet jargon, and acronyms. In this research project, I conduct a survey of literature on the potential effects of online communication on formal literacy, which will be followed by an online survey given to college level students ages 18 to 25. The goal of the empirical portion of the study is to see how students perceive the effects of active use of social media on academic writing. This research project will provide insights on the relationship between the two modes of written communication.

Major Objectives

With this research project, I aim to test the research question "Does texting, tweeting, and internet slang affect academic literacy, and if they do, how so?"
A secondary objective will be to answer "Does the informal use of English, including slang, differ too much from formal English, and therefore result in students not having adequate formal language skills for academic writing?"

Background Research with Analysis and Summary of Literature Review

Considering mobile phones and social media have been around for quite some time, a lot of research has been done on the matter of how text messages as well as short social media messages of any variety (direct messaging) impact young adults in the digital age. In his 2008 book, Txtng: The Gr8 Db8, David Crystal examines and assesses the use of text messaging and its effects on language and literacy. Based on findings, Crystal diverges from the popular opinion that the use of abbreviations and slang among children affects their literacy and spelling in a negative manner. Instead, Crystal debates that these modern modes of communication can actually enhance literacy (Crystal, 2008). His claims were based on six main points:

(1) in an average text message, less than 10% of the words are abbreviated; (2) abbreviations and abbreviating have been in use for decades, and therefore is not a new language; (3) both children and adults use text language, the latter being more likely to do so; (4) students do not habitually use abbreviations in their school assignments or exams; (5) a prerequisite to text is the ability to spell. Therefore, texting can not be a cause of bad spelling; (6) since texting provides individuals with the everyday opportunity of engaging with the language through reading and writing, it improves people's literacy. (Crystal, 2008)

McWhorter (2013) then, in his 2013 Ted Talk had similar opinions as well, as he claimed that texting language can be considered an expansion of the youth's linguistic repertoire. He explains that texting is just considered fingered speech, meaning we text the way we speak. McWhorter further elucidates that we may not think about capital letters or apostrophes when we text, and when we speak either. Texting has evolved to be more of a new structure, apart from writing. It has taken on more of a natural sense.

Mills (2014) conducted an extensive literature review on the effects of texting and tweeting on literacy. He found that while the use of mobile devices for short messaging can be used as one of the means of enhancing literacy education, it cannot be used without teaching students to distinguish between formal and informal writing and to use effective and separate strategies for each. In the proceeding of this analysis, Mills admits that although there is a widespread fear of mobile devices harming this generation's students, these claims are mostly anecdotal. Studies show that requiring students to engage frequently in "participatory multimodal writing activities, such as texting and tweeting" actually increases academic writing performance (Mills, 2014). This being said however, though texting and tweeting can offer advantages in the classroom, such as a new mode of communication to the students, Mills explicitly states that this does not translate to texting being a "magical cure-all for literacy and writing skills" (Mills, 2014).

In his 2017 article, "Texting Ruins Literacy Skills", Christopher Justice quotes publications that have said that texting is a "major problem" that causes students to write poorly, due to its oversimplification and production of "linguistic laziness" (Justice, 2017). However, despite these claims, Justice, in his ironically titled chapter, actually defends texting and its effects, quoting Crystal saying, "Texting is one of the most innovative linguistic phenomena of modern times" (Justice, 2017). Justice then discredits the myth of texting leading to illiteracy by bringing up how if this were the case, then it would be shown worldwide that literacy was at a decline. Instead, Justice makes the counterclaim that texting positively exercises rhetorical skills, since texts are customized to match different messages, audiences, etc., and several researchers have found positive correlations between texting and the literacy skills of texters (Justice, 2017).

Therefore, through a review of literature on the matter, it is a common theme that texting, tweeting, and internet slang do not have negative impacts on academic literacy. The negative correlation between the two has been popularized by anecdotal evidence, and has been proved as a myth. Through conducted and widespread research, texting itself does not have a negative impact on literacy, but instead, studies show positive effects as exercising literacy skills in any way will result in improvement.

The research done thus far on the matter indicates that there are gaps in that there has been no qualitative perspective on the students' views and attitudes, and there has been no focus on formal language as a whole, separate from slang.

Methods (Experimental Procedure/Design)

Populations and Sample:

My intended pool of participants for this project are college level students ages 18 to 25 that actively use text messaging or internet slang daily.

Data Collection:

Data will be collected through online surveys. The participants' identities will be kept secure, and not disclosed under any circumstances.

Neutrality:

Since this is an exploratory study, no hypotheses are being formed at this point. The survey will be distributed by me through available social media.

Consistency:

For the survey, the aim is one hundred participants in order to be able to conduct statistically valid analyses and arrive at reliable results. All participants will fill out the same survey.

Data Analysis:

An online survey will be made on Google Forms, consisting of questions about the participants' use of informal English in social media interactions. This survey will be circulated on social media and the data will be organized after all of it has been collected.

F. Results

Sample size: 61 responses from college level students aged 18-25

Demographics

4 Year College	Community College	Graduate School	Other
81.7%	8.3%	6.7%	3.4%

1. How many text messages do you send daily? Please estimate to the best of your abilities.

(These include: text messages, direct messages, etc.)

Fewer than 10	10 - 20	20 - 50	50 - 100	More than 100
15%	21.7%	31.7%	18.3%	13.3%

2. Do you use informal language, or slang, that is not classified under abbreviations? (These include: tea, cap, lit, highkey/lowkey, etc.)

Yes	No
85%	15%

3. Do you normally use any kind of punctuation while messaging? What kinds?

Yes	No
76.7%	23.3%

Comma	,	66%
Period	.	52%
Exclamation point	!	49%
Question mark	?	44%
Apostrophe	'	18%
Semicolon	;	16%
Other	"" () % " - : / _	59%

4. Do you ever have to write academic texts in your day-to-day life? (These include: essays, lab reports, research papers, memorandums, etc.)

Yes	No
86.7%	13.3%

5. What kind of academic texts do you write? Check all that apply.

Essays	Lab Reports	Research Papers	Other
90.9%	41.8%	63.6%	9%

6. How many academic texts do you write per week on average? Please estimate to the best of your abilities.

0 - 1	2 - 3	More than 4
62.7%	35.6%	1.7%

7. Personally, how difficult do you find using formal language in academic writing?

Not Very Difficult   **Very Difficult**
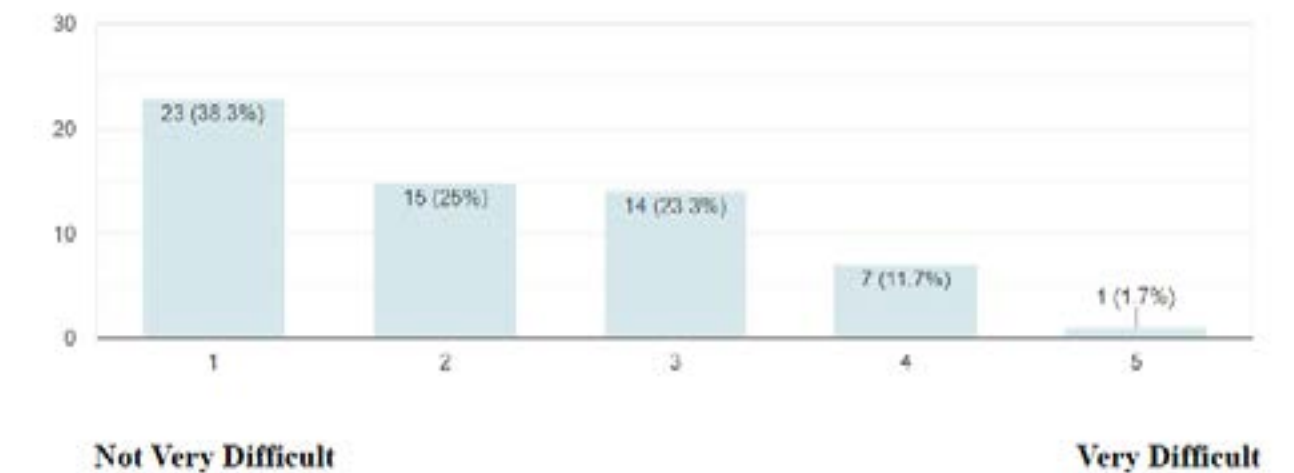
8. Personally, how difficult do you find distinguishing between formal and informal language use in academic writing? (Example: using the informal term "kids" rather than the formal term "children")

Not Very Difficult   **Very Difficult**
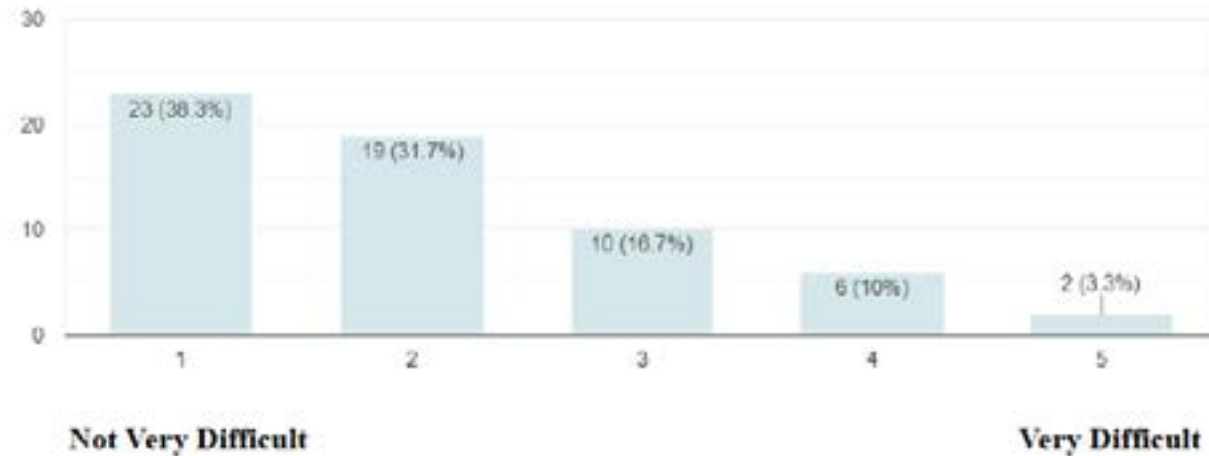
9. Personally, do you think your use of short social media messaging (text messages, direct messages, etc.) affects your academic writing?

NO, short media messaging has NO EFFECT on my academic writing	YES, short media messaging has a POSITIVE EFFECT on my academic writing	YES, short media messaging has a NEGATIVE EFFECT on my academic writing
72.1%	8.2%	19.7%

G. Discussion and Findings

Theme 1: By the time that students reach college, their perception of the difference between context/genre becomes clear.

- "I think having the **different voices and tones** come through text compared to academic writing **allows me to distinguish what is appropriate for either writing.**"

- "**When I'm writing in an academic context I try to think more academic**. Hence, my short media messaging has minimal to no effect on my academic texts."

- "**Completely different scenarios need different language usage.**"

Students are aware of language registers and when it is appropriate to switch them.

Theme 2: Short media messaging may interfere with punctuation use.

- "**My punctuation is terrible** in academic writing because **I'm used to write without proper punctuation.**"

- "**When writing I tend to not use as much punctuation**, and **grammatically I am illiterate** when it comes to writing."

- "**I forget** to end my sentences with a period"

These examples show that though many participants show confidence in the distinguishing of formal and informal language, many get tripped up on punctuation, tying back to McWhorter's point on fingered speech.

Theme 3: Short media messaging may be seen as positive as it gives students a way to develop as writers.

- "On social media I feel there is no filter, this has **allowed me to better express my needs** when sending emails. I feel that it has also **helped me better explain topics** and consider a more general audience."

- "Positive because I **can test out new words** I've learned in casual conversation."

- "Generally, I believe that texting has improved my academic writing because of the way that I text. By texting in complete sentences and **trying to incorporate a larger vocabulary**, it helps me to **practice my writing skills and benefits my writing ability.**"

There is still a possibility for *developing* writers to revert back to short media messaging language. From Theme 1, we saw that developed English students understood the difference

between language registers. Therefore, we are able to adapt to different codes, whereas in

Themes 2 and 3, we are able to see students who are still developing as writers, and who are able

to be flexible when it comes to writing level and skill.

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Cultural Discourse of a matchmaker's perceptions on love and relationships

Abstract

The study we conducted is one that will put U.S. mainstream cultural understandings of "love" in the center of our analysis. We interviewed 13 professional matchmakers, who deal in the business of love, dating, and relationships on a daily basis. Using Cultural Discourse Analysis (Carbaugh, 2007) as our main theoretical framework, we hope to unveil cultural perceptions of love, dating, and relationships from the view of those who do it for a living. We hope that by unveiling cultural understandings of the three themes from an "expert's perspective," we would be able to gain a better understanding of U.S. American mainstream deep-seated, potent beliefs of "love" as a cultural phenomenon and dating and relationships as uniquely cultural practices. Keywords: interpersonal relationships, cultural discourse, love, marriage, relationships, dating

Research Problem

The study we plan on conducting is one that will put U.S. mainstream cultural understandings of "love" in the center of our analysis. The goal of this study is to analyze U.S. cultural notions of romantic love from the perspective of professional matchmakers. Our research questions for this study are:

1. How do professional matchmakers in the U.S. define romantic love?

2. What do their conceptions about romantic love, as "experts" in the topic, tell us about our current social and cultural understandings of "love"?

3. How do their conceptions about romantic love relate to meanings of identity, relations, and emotion in our current society?

In asking these questions, we hope to answer deeper questions pertaining to our society including: the function of romantic love in sustaining a certain social structure (such as the nuclear family), and how cultural conceptions of "love" in the U.S. reflect our culture's ideals about identity, relationships, and emotion. We predict that, among other findings, matchmakers would champion a stable, long-term, understanding of romantic love as the basis for marriage, which in turn, supports our current societal structure, which is still primarily built on the notion of a nuclear family.

Keywords for Literature (Literature Map)
Keywords: interpersonal relationships, cultural discourse, love, marriage, relationships, dating

Literature Review

Love is often presented as a universal concept without much discussion of its social, religious, and cultural basis and background. However, a quick look at the history of love shows that different societies in different periods had very different understanding of love. With love having so many dimensions, it can be difficult to define it to fit into one cultural concept (Myers & Shurts, 2002). Beall & Sternberg introduced potential conceptions of that love could and could not be a universal experience and emotion that can be similar across all cultures, and it would have to depend on the culture to be determined (Beal & Sternberg, 1995). This means that love can be experienced differently based on the culture and it can change depending on the time and place a person is in. With so many avenues that love can expand to, it is important to know what the U.S. love culture is currently experiencing, because love can be related and understood by the socialization of the culture that you are in (Beal & Sternberg, 1995). In the research that Beall & Sternberg (1995) conducted, they hypothesized and argued that love was a social construct that would change based on the timeframe and culture that was being analyzed. This study's focus is to have a clearer view of the definition of love in U.S. culture in current (or contemporary) times.

One way to examine the U.S. love culture, is to consider the views and experiences of professional matchmakers. A matchmaker's main goal is to find their clients the 'perfect' match: someone with whom they could have a long-term, loving, and fulfilling relationship. They engage with issues of love, dating, and compatibility on a daily basis. As such, their perspectives on love would assist us in unveiling current cultural understandings of love in the U.S. It is also about representation. U.S. American studies on matchmakers have not included the voices of American matchmakers. Instead, the focus has been on other cultural practices. In fact, it's actually alive and well. There is such a thing as a modern, 21st century matchmaker, who uses social media to find someone their perfect match.

Most scholarly works that have been done about love and dating (Fitch, 2009; Montgomery, Sorell, 1998; Poutiainen, 2009; Ward, 2017; Weigel, 2017,) have neglected to include the voices of those who deal with these issues on a daily basis: professional matchmakers. These bodies of work have also often taken for granted that "love" means the same thing for the same cultural group over time (Beall, Sternberg, 1995; Noller, 1996; Soloski, Pavkov, Sweeney, Wetchler, 2013). The combination of a) tapping into the meaning of "love" in modern day American society and how it reflects our identity, relationships, and understanding of emotion, and b) featuring the voices of professional matchmakers in the U.S. (as opposed to other more commonly featured cultures in scholarly work pertaining to the practice of matchmaking such as Indian culture) makes this study a worthwhile and necessary pursuit.

Using Cultural Discourse Analysis (CuDA) (Carbaugh, 2007) as the main theoretical framework, we hope to unveil deeply held, potent, U.S. cultural understandings of romantic love as an emotion that cannot be separated from the current social and cultural context in which it finds itself. We also hope to tie findings of this study to larger questions of identity, relationship, action, and of course, emotion as understood in modern day U.S. society.

The analysis of cultural discourse helps bring awareness to how communication brings about a cultural tradition (Carbaugh,2007). With cultural traditions there is also the questions of how identity, action, relationship, and emotion can be expressed and developed in the U.S. A professional matchmaker is a great candidate to answer many of those questions. They must take a lot of factors into consideration when making matches and predictions for potential relationships or couples, communication and culture is on the menu to be examined. Cultural discourse analysis helps identify how communication and culture are intertwined with each other (Carbaugh, 2007). To make predictions about how two people will respond to each other, predictions must be made about their behavior, as well as predictions about what they may feel for each other in the future (Chapdelaine, Kenny, LaFontana, et al.,1994). Therefore, a matchmaker must take in consideration the values, ethics, how the couple will communicate with each other, and what is important to their clients to be successful in their predictions of love.

Research on matchmaking has been covered in East and Southeast Asia, not many studies have been conducted in the U.S. In the early 2000's there was a rise in international marriages, the rise these marriages called for a new career path for commercial matchmaking (Chee et al., 2012). In Malaysia, there was negative reports of some matchmaking agencies, that led to press on runaway brides as well as trafficked women (Chee et al., 2012). The research done by Chee et al. 2012), focused on the match between Chinese Malaysian men and Vietnamese women. They found that they first needed to find the male clients, they then needed to gain the trust build a relationship with the male clients. The second protocol in the matchmaking process, was that they then needed to find a source of Vietnamese women, this usually came from the matchmakers' connections. Finally, they had to go through immigration and other government obstacles to unite the pair. In their research, they found that Vietnamese women saw the match as prosperous, since she was moving to a new country, she would have access to more resources and social capital.

Cultures develop acceptable human interactions that are acceptable and normal depending on which culture one is in (Beal & Sternberg, 1995). In the U.S. it is expected and normal to get married. In fact, love and can be affiliated and used in the institution of marriage. With the U.S being an individualist culture it is a society that bases most of its marriage around love (Beal & Sternberg, 1995). A study was conducted on the other side of the world in South Africa, that focused on the dating app called Tinder. The study gathered data that was focused on why South African women were on the dating app (Tanner & Higgins, 2018). The study concluded that the women were on there for finding a relationship, fun, curiosity, socializing, and flirting (Tanner & Higgins, 2018). In this study marriage and family were not the ultimate goals of using Tinder.

Love has a lot of different definitions, and researchers have been trying to a clear meaning of what love was being displayed as. To identify the construct of love, Myers & Shurts (2002), reviewed different articles that had defined, hypothesized, and explored love in literature. Their review included the parts of love that were measurable. They used a Likert Scale to measure 9 different measures of love. The instruments that needed to measure love had different criteria to follow. These instruments had to gage love and the different dimensions of love, that love must be a major part of the article, as well as the

different theories of love (Myers & Shurts, 2002). They found that with the articles they reviewed that the definition of love was found to be restricting. They also found that the authors often abstracted love into other forms, such as compassionate, romantic, or was not clear in the way love was being used in a relationship (Myers & Shurts, 2002). They concluded that the meaning of love has an opening to have a concise meaning in future research, as the construct still has a lot of ambiguity.

Love has so many interpretations, as well as theories that try to make sense of the components of love that are felt. Love can be expressed and developed in a variety of different subtypes, that can be expressed by these conceptions of love. Robert Sternberg is the creator of the 'triangular' theory of love, which has these three major components: intimacy, passion, and decision/commitment (Sternberg, 1986). The intimacy part of the triangle has the feelings of connectedness, bondedness in relationships, and closeness in loving relationships. The passion part of the triangle has the romance, sexual and physical attraction, that are in loving relationships, (Sternberg, 1986). Finally, the decision/commitment part of the triangle has the short-term commitment and the long-term commitment as integral components that correspond to each other in loving relationships (Sternberg, 1986). The short-term love is the decision to love someone, and the long-term commitment is the decision to and commitment to keep the relationship going, (Sternberg,1986). According to this theory, different relationships will go through the love triangle at different angles which depend on the loving relationship. It will be interesting to see if the U.S. cultural discourse on relationships go through all the sides of the love triangle or if one side is more dominant than another.

Method

Participants Data Collection: We plan on conducting 10-15 interviews with professional matchmakers. Participants will be recruited through a combination of email recruitment (sending out emails to matchmakers seeking their participation in our study) and snowball sampling based on participants' recommendations on whom we should connect with for this project. We plan on conducting 30-40 min face-to-face interviews via zoom. The interviews will be recorded. Participants will sign a consent form prior to the interview. Participants will be asked to provide a pseudonym we will use to protect their privacy.

Operationalized Definitions

"Cultural discourse analysis" is a specific way of examining communication ethnographically," (Carbaugh, 2007).

"Social Cultural" this is a term that is associated with the social and cultural factors, which means common traditions, rituals, patterns, and beliefs present in a culture, population or group.

Materials, apparatus, etc.

• A Zoom account will be needed
• Computer
• Access to the participants

Measure

Interview Questions

1. How did you become a matchmaker?

2. What's your favorite thing about your job?

3. What's your least favorite thing about your job?

4. What's one thing you wish people knew about matchmakers? This is where you can correct some misperceptions perhaps you might have heard about matchmakers/being a professional matchmaker?

5. What's one thing you wish people knew about love and dating that would save them from heartache/trouble/save them a lot of time?

6. What are the ingredients for a successful match? In other words, how do you match people? How do you know if they're compatible?

7. If you could describe love using a word, metaphor, an illustration, what would it be? And why?

8. Is there anything else you'd like to add before we conclude the interview?

9. Do you have any questions for me about the study?

10. Is there someone else you would recommend me to interview for this study?

Procedures

• We will be conducting qualitative data transcribe themes. Interview questions
• Procedure for data analysis
• Interview recording by zoom
• Transcriptions outsourced to service
• We will be using Cultural Discourse Analysis to extract themes from the interview Descriptive: Interviews will be transcribed. We will then extract key themes based the transcription.

• Interpretive: following the main theoretical framework we are using for our analysis, Cultural Discourse Analysis (CuDA), we will extract cultural propositions (which are sentences we put together based on key terms used by participants) and cultural premises (statements containing what exists and what is valued based on cultural propositions we created).

• Interpretative analysis
• Writing the report on the information we have gathered from the interviews

Ethical Considerations

• Confidentiality pseudonyms
• Participation
• Consent form's purpose of the study
• No tricks Interview questions
• Participants have the right to ask for an interview to not be recorded on zoom

Results/Findings

Descriptive Analysis

In the descriptive analysis there were themes that came out of the discourse with the matchmakers. Here is the summary's based on the questions they were asked. Themes

• Love and know yourself
• A person needs to get rid of the long list of must have qualities
• Date different types of people

Love and know Yourself

...Prerequisite to finding love truly, you know, loving yourself and not looking for someone to fill a hole in your heart.... -Shannon

...Like, it's really about getting quiet with yourself and figuring out Oh, my gosh, what do I really want? And I think that kind of work takes some time and effort. It really does. And I think it comes through experience of dating a lot of different kinds of people. -Kara

...So you're more looking to see what you can give to another person, rather than just what you can get from them - Christie

...it starts with you, it starts with your mindset, it starts with what you think is possible for yourself. It starts with what you think you deserve. It starts with your own self-worth and self- value, and really understanding what makes you feel safe and secure and happy, independent of what your family wants.... -Kara

... dating is like learning about yourself exploring meeting new people and searching for that person...-Kristen

.... Like, the perfect guy comes to you and you're not ready to really like you're not emotionally available. You're not ready to like, form a real relationship. Only you can change that. -Robyn

...I would define dating as like the process, like internal process and extra process of getting to know yourself and getting to know other people that you can see a shared like future together...- Christie

... dating is, is a path to start to see in ourselves, how our judgments, our beliefs, or ideas are preventing us from having love in this moment, or sharing love in this manner... -Carina

...Love is balance. And I still kind of that's like a word that I always go to in my life. I think personally, you need balance, but in relationships, you certainly need balance.... _Becky

...the vending machine component. That happens a lot when people have a lot of like, boxes that they feel like they need checked. That will translate into like happiness, like they think, okay, I need all these things to have a happy relationship.... –Christie

...I think it's really important to know from the get go that this is just as much about you, you know, this is just as much about getting to know yourself and matching with who you are and what you want and what works for you. -Kara

... thedatingis,isapathtostarttoseeinourselves,howourjudgments,ourbeliefs,orideas are preventing us from having love in this moment, or sharing love in this manner...-Carina
... it's that believing in the other person, it's about having their back. It's about having your own back. It's about loving yourself... - Shannon

A person needs to get rid of the long list of must have qualities

...I think number one, throw out the laundry list of like, your must haves, I would say pick three, you could have one superficial thing that's important to you that they're fit or whatever it is. If you're really looking for a genuine relationship, you have to look beyond that... -Amber

... Keep it moving. keep focusing on what you're liking about the person rather than why they're not going to, like be a fit -Becky

... I've never heard a woman say, Man, my husband is so amazing. He's a great father, a great husband, because He's six feet tall. Height has nothing to do with it...- May

... I first started doing this four years ago, I was so particular, you know, I really tried to get every box on someone's list, I worked so hard. And some of those dates would be the biggest flops ever. And it was just because either the vibe wasn't right, or, you know, I mean, there were things that neither person put on their list that both of them really wanted, or, you know, there's so many reasons why just checking up the list doesn't work -Kara

... I think that oftentimes, we're swiping past the right types of people, because we're just missing out on someone based on an injury, or a year or a degree. -Erika

.... We give them three must haves, this is new, three must haves of values are qualities that we won't introduce them to someone unless they have those three must haves. -Kristen

... when we start out looking at how we're going to match, we, of course, start with the client, and we're looking at what they're they want, we look at three months tops, 10, deal breakers, and three, or sorry, three must haves.... – Becky

...My second tip is again; it goes back to say yes to anyone who asked you out. It doesn't matter that your first impression is like. -May

... The goal should not be checking boxes on a list. -Kara

... we all have some qualities that need refinement, we all have some, some things about us that could be worked on, and those things tend to be reflected back to us in the process of dating. If I had I think every matchmaker would agree, if we could make love like that if we could just pull builds a bear guy out or build a bear...-Carina

Date different types of people

... we might push a little bit or show you someone a little bit outside of, you know, the box or outside of, you know, your comfort zone. And those are a lot of our success stories... -Becky

... As a matchmaker, I cannot build the right person. I wish I could, you know, I would offer that. But that's not how it works. - Carina

...I think a big part of love is just making that choice. –Erika

... I think it comes through experience of dating a lot of different kinds of people. - Kara

... To give the good guy more of a chance, I always say that you want to look for like 90% go guy in 10% edge. – Becky

... So, when two people's sort of vision of the fairy tale of mine, that's really great matches tend to happen. And unfortunately, a lot of the times those boxes that people are trying to tick maybe aren't, but when I hear them describe the same kind of future that they want to work with someone, I still go for the match, and quite often those workout... - Becky

... I wish that they knew their person's probably coming in a different package than they expect. And to be open minded...-Tailia

... Like, everyone always says, I want to tall guy I want him to be at least you know, 510 is like usually what they'll say. And then as soon as I say, well, it's the perfect guy came around, and he was five, eight, but he's everything else that you're looking for. Yeah, there's always yes. You know what I mean? But then once you really put it all into perspective, people really just want the right partner. - Robyn

Data Analysis: Cultural Premises

What exists:

• The ability to make choices in one's search for love (action)
• A "laundry list" of superficial qualities people use to find their ideal partner (action)
• The urge to find someone to just "fill a hole" in one's heart (emotion)

What is valued:

• Self-love (emotion)
• Self-reflection (action)
• Dating different types of people (action)
• The ability to look beyond superficial qualities (action)

Discussion

As professionals who deal with issues of love and dating on a day-to-day basis, matchmakers we interviewed suggest that we let go of the notion that we can only be happy and fulfilled when we find a perfect person who meets our often-superficial criteria. The long list of superficial criteria is not optimal when we are looking for a partner. This list can alienate a potential partner. Instead, they recommend that we start our search for love by engaging in contemplative work to find out who we truly are and what we are truly looking for in a partner. Moreover, they tell us that without self-love, we would not be able to find our perfect match. Therefore, a connection can be made based on the third date and beyond. Being able to love yourself and know yourself was also a theme that continued in the research. Without loving yourself first they found that finding real love would be a hard task. A person must be able to know what they like about themselves to love qualities of a potential partner. They recommend that we go on at least three dates, with someone who might not be our, "type." As well to be open to "falling in love," later. Matchmakers suggest that after three dates a person will be able to get know a person. The first two dates a person is still getting over the dating anxiety of meeting someone new, so by the third date they will be able to relax and be themselves.

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Cunningham Omari*   **Assessing the Relationships between Social Media use and Sustained Attention**

Abstract

        Social media and social networking have become enormous parts of our daily lives. It is evident from the changes in the way we interact with each other interpersonally, to their rapid integration as the preferred modes of communication adopted in educational and vocational domains. Problems arise however when we become fixated on garnering likes, retweets, and tags on various social media platforms. We find ourselves spending more time than intended on these sites, coming up with witty tweets or finding just the right selfie angle. There is good reason to believe that these undesirable outcomes are not entirely our fault. Documentaries like 'The Social Dilemma' contain testimony from engineers of these apps; claiming that the apps are in fact, strategically designed to grab and hold onto our attention. Furthermore, the literature reveals several studies ranging from broader topics such as symptoms of psychological disorders and their relationship to addictive video games and social media use (Andreassen et al., 2016), to more specific topics like smart phone use and everyday inattention (Marty- Dugas et al., 2018). The findings from Andreassen suggests a strong correlation between ADHD symptoms and addictive social media use. It is possible that social media influences these symptoms, but it has yet to be determined in what way. As such, this study intends to investigate the potential relationship between social media and sustained attention by collecting survey data on a large sample's general social media engagement habits and subsequently analyzing the results.

Major objective(s):

• Finished constructing survey and re-evaluated initial analytic plan.
• Presented preliminary research at Mcnair symposium.

Background Research:

• in a classic study by mischel, researchers looked at whether children were able to delay short-term gratification (one marshmallow today) in view of a larger prize(more marshmallows tomorrow). Importantly, children who were able to distract themselves from the marshmallow in front of them showed how they could control how much cognitive resources they allocated toward the marshmallow and were able to resist their urge to take the short-term pleasure in view of the longer-term more gratifying reward.

• MIschel's study followed children over the course of their lives and found that children who were better able to forgo short-term pleasures for greater long-term rewards were found to be more successful later in life. studies like Walter MIschel's Marshmallow study show us how control over one's attention span is quite a valuable skill

• In 2010 Kirschner and Karpinksi found that excessive facebook use lead to declines in academic performance. It is understood that social media applications are far more advanced and attention grabbing than they were in 2010.

• In 2016, Andreassen et. al, found a strong significant relationship between Social media overuse and attention deficit disordered behaviors Andreassen was able to find a significant relationship between adhd behaviors broadly, but particular maladaptive behaviors such as sustained attention difficulties have yet to be explored.

• Social media sites and applications like YouTube, Instagram, Facebook, Reddit, and Twitter all function and rely on users taking part in what is known as an attention economy (Coxon, 2017). On this notion we aim to further explore the relationship between sustained attention and social media engagement via social media use.

Procedure:

• Gather sample data on social media usage and sustained attention via qualtrics survey from participants.
• Analyze self-reported data and compare findings to composite inattention item scale(ARCES).
• Interpret the results of the analyses and report findings.

Participants: (Potential) n = 100

Measures:

● Independent measures: Social Media Engagement, Engagement will be measured via a Social media survey Composed of items from the MAAS-LO, SUQ, and original items

● Dependent measures: Sustained Attention capacity measured via a composite score of inattention items obtained from the Attention Related Cognitive Errors Scale (ARCES)

Variables to be represented in a table (In progress)

IV/DV
IV: Social media engagement levels
DV: Scores of attentional capacities via ARCES composite scores of inattention (reverse coded)

Materials:

A Survey will be used to assess social media use levels and attention capacity levels
Instructional video: The instructional video will be used to help operationalize social media engagement.

Data analysis:

• Correlational analyses via SPSS

Discussion:

If we are able to find a significant relationship between our variables of interest then we have grounds to continue testing with behavioral measures like the continuous performance test and digit span test.

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Final Report for the Learn Through Discovery Projects Hatchery at California State Polytechnic University, Pomona

Abstract

RICH Tribe LA is a lifestyle streetwear brand whose products are for the creative and conscious consumer who is in the market for contemporary, fashion-forward apparel and accessories. Our target market is men and women from the ages of 24 to 36 years old who have a college education and have an estimated annual income of $70,000 or more. RICH Tribe LA will seek to diversify the options of sustainable streetwear by featuring handwoven textiles from indigenous tribes of the Philippines and working directly with them as an example of ethical practice. The customer discovery will be based on the hypothesis that our customers are 1) in the market for fashion-forward, contemporary apparel that is comfortable and functional, 2) becoming more aware of the environmental impact of the apparel industry and are opting for more eco-friendly clothing, 3) willing to spend more on products that are ethically and sustainably made, and 4) seeking for more knowledge and transparency about the brands they are supporting.

Introduction

RICH Tribe LA represents the bridge between streetwear and tradition, unifying street-born designs with cultural practices. The purpose of my project is to continue an ongoing mission to preserve the traditions of handweaving textiles of the indigenous tribes of the Philippines, as well as having an ethical and environmentally conscious approach to designing and producing apparel. I intend to serve my customers with quality and unique garments, and the livelihoods of the weavers in the Philippines. As a senior, I have learned so much in the Department of Agriculture as an Apparel Merchandise and Management major, and I appreciate the opportunity to use my knowledge and skills to make a positive impact. This project is supported with the best intentions to use the knowledge I have gained at Cal Poly Pomona and to use the skills I've learned to educate my customers on the communities they will be helping, and the positive impact they will be a part of. This project is unique in several ways – 1) I will be working directly with the master weaver of two tribes to curate textiles that are unique to RICH Tribe LA, 2) I will be designing a collection and sourcing all the materials, 3) the collection will be made in the Philippines, 4) sustainability and ethical practices are the priority, 5) my customers will have an opportunity to experience a side of the Philippines many are not aware of. As a Filipino-American, having the opportunity to work with people of my heritage to create an apparel collection is an honor.

Goals

Initial Goal: For this project, my goal is to release a full collection that features handwoven Philippine fabric sourced directly from two indigenous tribes.

Specific: I will be releasing a five-product collection that features handwoven Philippine fabric. The collection will include a men's t-shirt, women's t-shirt, unisex basketball shorts, bucket hat, and face mask. I will be working with my business partner to handle all the responsibilities to accomplish our goal, as well as our partner in the Philippines who will be producing our garments. The project was started in February and will take about 5-6 months to complete, so our projected release date is end of June. My partner and I decided to go forward with this project because we enjoy designing clothes, and we also want to make a positive impact in the apparel industry.

Measurable: I will be able to measure our progress through each milestone we complete. Each milestone has a checklist that needs to be complete before moving onto the next milestone.

Achievable: I know this goal is achievable because it will be my second collection. I learned a lot from the first collection that I released for my brand, so I was able to apply all the I learned to this collection. The biggest challenge with this collection I would say is time because due to COVID restrictions, we are experiencing more than normal delays on production. Regardless of the challenges, I am determined to go above and beyond to find solutions to make sure this project is complete.

Relevant: I will be graduating this semester with Apparel Merchandising and Management under my belt. This is the perfect project to showcase my knowledge and skills that I have learned here at Cal Poly Pomona, as well as catapult my career as the CEO of my clothing brand.

Time-Bound: This project is projected to take about 5 to 6 months to complete, and it is a very realistic timeline when considering a normal design and product development lead time for a clothing company takes around the same amount of time.

Smart Goal: For this project, my goal is to release a full 5-product collection that features handwoven textiles that was sourced directly from two indigenous Philippine tribes in about 5 to six months. I will be applying the knowledge and skills I have learned over the past 4 years to ensure exceptional execution.

Methods

Customer Discovery – RICH Tribe LA
Introduction

RICH Tribe LA is a lifestyle streetwear brand whose products are for the creative and conscious consumer who is in the market for contemporary, fashion-forward apparel and accessories. Our target market is men and women from the ages of 24 to 36 years old who have a college education and have an estimated annual income of $70,000 or more. RICH Tribe LA will seek to diversify the options of sustainable streetwear by featuring handwoven textiles from indigenous tribes of the Philippines and working directly with them as an example of ethical practice. The customer discovery will be based on the hypothesis that our customers are 1) in the market for fashion-forward, contemporary apparel that is

comfortable and functional, 2) becoming more aware of the environmental impact of the apparel industry and are opting for more eco-friendly clothing, 3) willing to spend more on products that are ethically and sustainably made, and 4) seeking for more knowledge and transparency about the brands they are supporting.

I interviewed 5 different customers. The purpose is to discover evidence that supports my hypothesis and to indicate solutions to pain points that I can implement into my business model. The questions I asked are as follows:
Questions

1. What are some primary considerations you have when purchasing clothes?
2. What do you consider ethical sourcing and sustainable manufacturing when you purchase clothes?
3. How much do you typically spend on clothing?
4. Are you more likely to spend more on apparel and accessories with the knowledge it was made ethically and sustainably? Why or why not?
5. What are some expectations you have for a sustainable brand?

Principal Questions:
- Do people care enough to support ethical and sustainable brands?
- Are they willing to pay more?
- Is there a market for sustainable streetwear?
- Do people need transparency to justify the price?

The results from the interviews both challenged and supported my hypothesis. Overall, there is a market in sustainable streetwear, and people are willing to purchase higher-priced products due to their ethical and sustainable qualities. After finishing up my market research, I realized that although more brands are introducing more ethical and sustainable practices into their processes, there was a lack of representation in the Philippine community. There is an endless list of brands that take influences from Asian cultures such as Japanese, Chinese, Korean, etc., but I have not found one Philippine-influenced brand in the streetwear market that is sustainable. The purpose of RICH Tribe is to implement ethical sourcing and sustainable manufacturing into the production of apparel and accessories while introducing Philippine textiles to the streetwear market.

Through the discovery process, two main themes appeared from the surveys: the purchasing habit of our interviewees depends on the quality and design elements, and most consumers are not fully knowledgeable of what is considered ethical and sustainable unless the brand discloses it. This addresses several principal questions that RICH Tribe plans to answer by not only producing quality products with the customer's comfort, functionality, and budget in mind but also using our platform as a source to educate our consumers of the environmental impact of the apparel industry. If we investigate the future of retail, we will see more companies becoming more transparent to their customers to achieve an advantage over their competitors.

For this project, the goal I intend to complete is to design and create an entire collection that features handwoven Philippine textiles and other sustainable materials that will be available to purchase on my brand's website (www.richtribela.com). This entire collection will be custom designed for customers of RICH Tribe LA and will include an all-around experience with my brand- from quality product to the packaging, all inspired by my Philippine heritage. I have divided each process by milestones.

Milestone I: I have already designed the entire collection for this project. It will be called "RICH Tribe LA 'LGNDSNVRDIE'"- a five product collection consisting of men's t-shirts, women's cropped t-shirts, basketball shorts, face masks, and bucket hats. I already contacted the tribes I will be working with and ordered the fabrics I will be using in the collection. The fabrics are now completed. I also have a partner in the Philippines who I am coordinating with to manufacture my designs. I already shipped him the completed handwoven textiles so now we are coordinating to produce the samples. For milestone I, the funding required will be to pay for the handwoven textiles and labor to produce samples.

Milestone II & III: I will be sourcing all other fabrics and materials necessary for my designs. I will be coordinating directly with my partner in the Philippines to produce the samples of my designs. I will also start designing and ordering packaging materials. For milestone II, the funding will be used to pay for the remainder of the raw materials, packaging materials, and down payment for the labor cost of production. Samples typically take about 2-3 weeks to produce, and depending on if they need revisions, it could take longer. Milestone II will require more time because sourcing and production normally takes the most time. I am currently in Milestone II and have been coordinating with my partner in the Philippines for mock samples. Once samples are approved, I will be moving onto Milestone IV.

Milestone IV: Once the samples are approved, I will be coordinating with my partner in the Philippines to prepare my designs for the main production. Once production starts, while waiting to be completed, my business partner, Christine, and I will be using the samples to create marketing content and hire models for photoshoots to model the collection. Since one of our mission as a brand is sustainability, our collection will be produced in low quantity (500 pieces total) to prevent overstock. Production typically takes 3-4 weeks. The funding for Milestone III will be used to pay for the remainder of the production cost and any marketing cost needed for models and photoshoot equipment. Once all marketing material and production is complete, we will go live on our website for purchase. My projected release date for the collection is around the end of June.

Results

The approach that I took with this project was first creating a customer discovery to indicate any pain points my perspective customers may have and find solutions that will solve them. I came up with four hypothesis that my audience is -1) in the market for fashion-forward, contemporary apparel that is comfortable and functional, 2) becoming more aware of the environmental impact of the apparel industry and are opting for more eco-friendly clothing, 3) willing to spend more on products that are ethically and sustainably made, and 4) seeking for more knowledge and transparency about the brands they are supporting- about my customer audience and found two main themes that appeared from the surveys.

The two main themes that appeared from the surveys were that 1) the purchasing habit of the interviewees depend on the quality and design elements, and 2) most consumers are not fully knowledgeable of what is considered ethical and sustainable unless the brand discloses it. This addresses several principal questions that RICH Tribe plans to answer by not only producing quality products with the customer's comfort, functionality, and budget in mind but also using our platform as a source to educate our consumers of the environmental impact of the apparel industry.

For this project, the collection is influenced by Laker legend, Kobe Bryant. My approach to designing this collection was to make it comfortable, design-oriented, and affordable. From the first theme I discovered, most consumers purchase a product because 1) it looks good and essentially does what they want (design sensibilities), and 2) the price must justify its quality ("you get what you pay for"). The primary issue behind having products with design sensibilities is cost because 1) the more intricate the design, the higher cost it will be to produce, and 2) high-quality fabrics with functionality are expensive. The advantage, however, of well-designed products is durability and a longer lifespan. This would be considered a sustainable quality because it will take longer before the product's natural wear and tear. As a result, the design and quality of the end products were created with design sensibilities that is also affordable.

I designed a bucket hat with removal drawstrings and a side pocket on the hat to serve as storage for the drawstrings. The bucket hat will be reversible and is incorporated with our first and second handwoven Philippine textile. Next, I designed two staple pieces, one for men and one for women. For the men, I designed a double-hemmed t-shirt and for the women, I designed a crop tank top. Both pieces are intended to style perfectly with the final design. For the final design, I designed a pair of unisex basketball shorts with pockets and a drawstring that incorporates our third handwoven Philippine textile. The collection supports the first theme of the discovery process because 1) each garment is designed with the customer's comfort and functionality in mind, and 2) all raw materials are carefully and ethically sourced to further enhance the garment's sustainable qualities.

Through the second theme, I discovered that the common consumer 1) does not know the meaning of being ethical and sustainable because the brand does not market themselves as sustainable, and 2) does not normally purchase from sustainable brands. This disproves my hypothesis that consumers are becoming more conscious about the environmental impact of the clothing industry, however, proves a pain point of the lack of transparency in brand marketing. As the sustainable market is growing, people will eventually start becoming more environmentally conscious once more major brands include ethical and sustainable practices into their branding. As a result, I cannot fully claim the products are 100% sustainable, however, I can market the brand to be making sustainable and social conscious approaches with low quantity production, sustainable packaging, and working directly with Philippine weaving tribes.

RICH Tribe's current manufacturing process is considered sustainable because of our low quantity production. By having our products produced in smaller batches, it reduces the chance of overstock and waste. Our sourcing process is considered ethical because we work directly with the weaving tribes of the Philippines to source our textiles and include

other sustainable materials in our packaging. For this project, our raw materials are about 85% sustainable except for using premade fabrics that contain polyester. Our plan for the near future is to include 100% sustainable materials such as natural threads and dyes into our textiles. For shipping packaging, we will be using biodegradable plastic and paper boxes.

Conclusion

In conclusion, the collection encompasses two very diverse cultures- the Philippine culture and basketball culture. The strategy was to relate to two very diverse audiences at the same time give a deeper meaning to the apparel so when people wear the clothes, they can appreciate the little details from the design to the fabrics. Referring to the customer discovery process, this collection touched on several pain points. Firstly, this collection achieved quality and design sensibilities within budget by including premium materials and featuring functional design elements. Secondly, this collection features handwoven from three tribes of the Philippines- the Itneg Tribe, Ifugao Tribe, and Tuwali Tribe. By including handwoven Philippine fabric, we can market our brand as socially conscious by supporting local artisans in the Philippines.

The first theme regards to design sensibilities. I was able to accomplish this with each piece within budget which makes the collection attractive to those who are looking for functionality and practically in their wardrobe as well as keeping the items affordable. The second theme regards to sustainability which I was not able to achieve 100% because of cost of materials. To achieve 100% sustainable products, it would have costed about three times the budget available, so instead I opted for other areas to apply sustainability which was in low quantity production per item and sustainable packaging materials. To market the collection, I will market it as a collection that features handwoven textiles from the Philippines and disclose my methods of pursuing sustainability.

In the final phases of this project, we accomplished the photoshoot, created marketing content and a brochure about the collection, and completion of production. I will be working with my team to reach out to media companies, retailers, and pop-up events to promote the collection which is projected to officially release on October 8. Since we cannot market the collection as 100% sustainable, our strategy is to promote the collection that features traditional Philippine textile which we hope to attract conscious consumers. We will also disclose our commitment and pursuance to becoming sustainable. In future collections, I will continue to make it a goal to include more sustainable practices to achieve 100% sustainability.

I learned many things from this project. The customer discovery served as market research where I was able to narrow down my target market, which is the conscious consumer. There is a lot of depth in market research than what is taught in textbooks and is only achievable once its applied. For example, I was taught that market research is to discover a target market and to see if there's a market for a product, but when applied, I found out there is more details to a customer such as buying habits and what a customer looks for when shopping. This discovery was available through the survey. I also learned the meaning of compromise. This regards to compromising my original plan and adjusting

where it was needed to save on cost without jeopardizing the overall goal. This area was specifically in sourcing materials, where originally, I wanted to produce a sustainable collection but due to cost, I had to settle with low quantity production. Low quantity production may make it slower to achieve revenue, but it is a form of sustainability that I believe is more valuable.

This project can be taken into the future with a different collection that includes more sustainable practices, which is my plan. The biggest mistake I believe I made was overreaching within my capacity which resulted in many adjustments and revisions, so for the future, I will plan a collection within a set budget so that it will lessen unnecessary expenses that was caused by revisions. For anybody who is interested in doing a similar project, I would suggest starting with a plan whether it is producing a collection or creating one innovative design, planning helps ease the transition from phase to phase. I would also suggest working with a partner who has the same vision and goal as you, better if they are a fellow student, but also okay if not. This helps take off the load of your responsibilities so you both can perfect your specific department. Finally, I would suggest to only to start a project if you are truly passionate about it and are committed to completing it. A project like this will take a lot of your spare time and will require a lot of patience and work. Those who are working full-time and going to school who would also like to do the Project Hatchery will have a very difficult time achieving a project within a time frame. Overall, I believe the Project Hatchery is a great fit for young entrepreneurs who are looking to start their own company but need guidance and a little bit of financial help. The Project Hatchery helped me gain confidence to reach out to potential investors if I ever need to reach out for help. The Project Hatchery is a great source for open opportunities.

Team

Team Member 1: Ria Custodio
• **Qualifications:** Senior, Apparel Merchandise and Management, Department of Agriculture
• **Position:** Head Designer, Product Development Manager, Sourcing Manager
• **Responsibilities:**
    o Design collection
    o Coordinate and communicate with manufacturer
    o Communicate with Philippine master weaver
    o Maintain production processes- technical flats, measurement charts, tech packs, etc.
    o Source fabrics and materials
    o Arrange payments
    o Help with marketing content and photoshoots
Team Member 2: Christine Hernandez
• **Qualifications:** BS International Business, Cal Poly Pomona Alumni, C/O 2018
• **Position:** Marketing Manager, Design Assistant, Sourcing Assistant
• **Responsibilities:**
    • Source fabrics and materials
    • Hire models and host photoshoots
    • Update website
    • Maintain Instagram and Facebook accounts
    • Create marketing content

Budget

Milestone 1			
Type	**Description**	**Qty**	**Budgeted**
Philippine textiles	Materials	1	1500
Sample 1	Production cost for sample 1	1	100
		Total	$1,600.00
Milestone 2			
Type	**Description**	**Qty**	**Budgeted**
Fabrics	Cotton, Polyester fabrics	1	1000
Materials	Drawstring, labels, packaging	1	300
Labor	Downpayment for Production Cost	1	700
Sample 2	Production cost for sample 2	1	100
		Total	$2,100.00
Milestone 3			
Type	**Description**	**Qty**	**Budgeted**
Labor	Remaining production cost	1	1300
		Total	$1,300.00

TOTALS			
How many student team members do you have?		1	**Milestone 1**
Allotted Budget		$5,000.00	**Total** $1,600.00
			Milestone 2
			Total $2,100.00
			Milestone 3
			Total $1,300.00
			Entire Project
			Total $5,000.00

LGNDS NVR DIE
S/A 2K21 COLLECTION
LOOKBOOK

TABLE OF CONTENTS

THE INSPO

RICH Tribe's Summer 21' collection pays tribute to basketball Laker legend Kobe Bryant. This collection inspires the memories of wisdom, skills, talents, and the positive influence of the legends who we look up to. Weaving together diverse cultures to honor our ancestors and to pay tribute to the influential and respected greats who came before us. LGNDSNVRDIE includes a selection of classic LA pieces fit for comfort and finesse.

THE WEAVERS

Our collection features fabric from the Itneg Tribe, Ifugao Tribe, and Kalinga Tribe of the Philippines. We handpicked thread colors and patterns to create custom textiles distinctly for our LGNDSNVRDIE Collection.
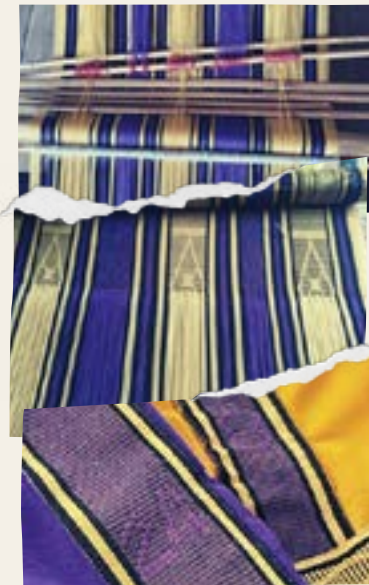
TUWALI TRIBE - PINILLIAN WEAVING

ITNEG TRIBE - PEDAL LOOM WEAVING

KALINGA TRIBE - BACKSTRAP WEAVING

CUSTOM-HAND WOVEN TEXTILES

MVP
Our logo took inspiration from the Tuwali Tribe from Ifugao, so we created a custom "pinillian" design that hand wove our "RICH" eye logo and the numbers 8 & 24 in the textile. Pinillian is a complicated weaving technique that uses sticks inserted on selected warp threads to create complex curvilinear designs of human figures, horses, constellations, and many more.

ILLATA
Handwoven textile called "Illata" means "eyes" in the Kalinga dialect. Hand woven by the Kalinga Tribe from Kalinga, Philippines, the weavers of this tribe are known for practicing traditional backstrap weaving techniques. The design motifs and patterns used are typically beliefs-based, and nature-inspired such as birds, other animals, mountains, and stars.

MATA-MATA
Mata Mata in the Tagalog dialect means (eye), and is often used to depict mountains, rice grains, and the bounty of the earth. In some communities, Mata Mata is used as a body tattoo motif. Origin: Hand woven by the Itneg Tribe from Abra, Philippines.

WHIRLWIND
The whirlwind fabric is woven using the binakol technique. The patterns of binakol cloths are ancient, and are dizzying on purpose. Traditionally, the design can resemble the women's naval which means "to give light to life", and in other practices is referred to as a "whirlwind" which gives protection from evil spirits that hover overhead and prey on sleeping souls. Origin: Hand woven by the Itneg Tribe from Abra, Philippines.

DUB HEM TEE
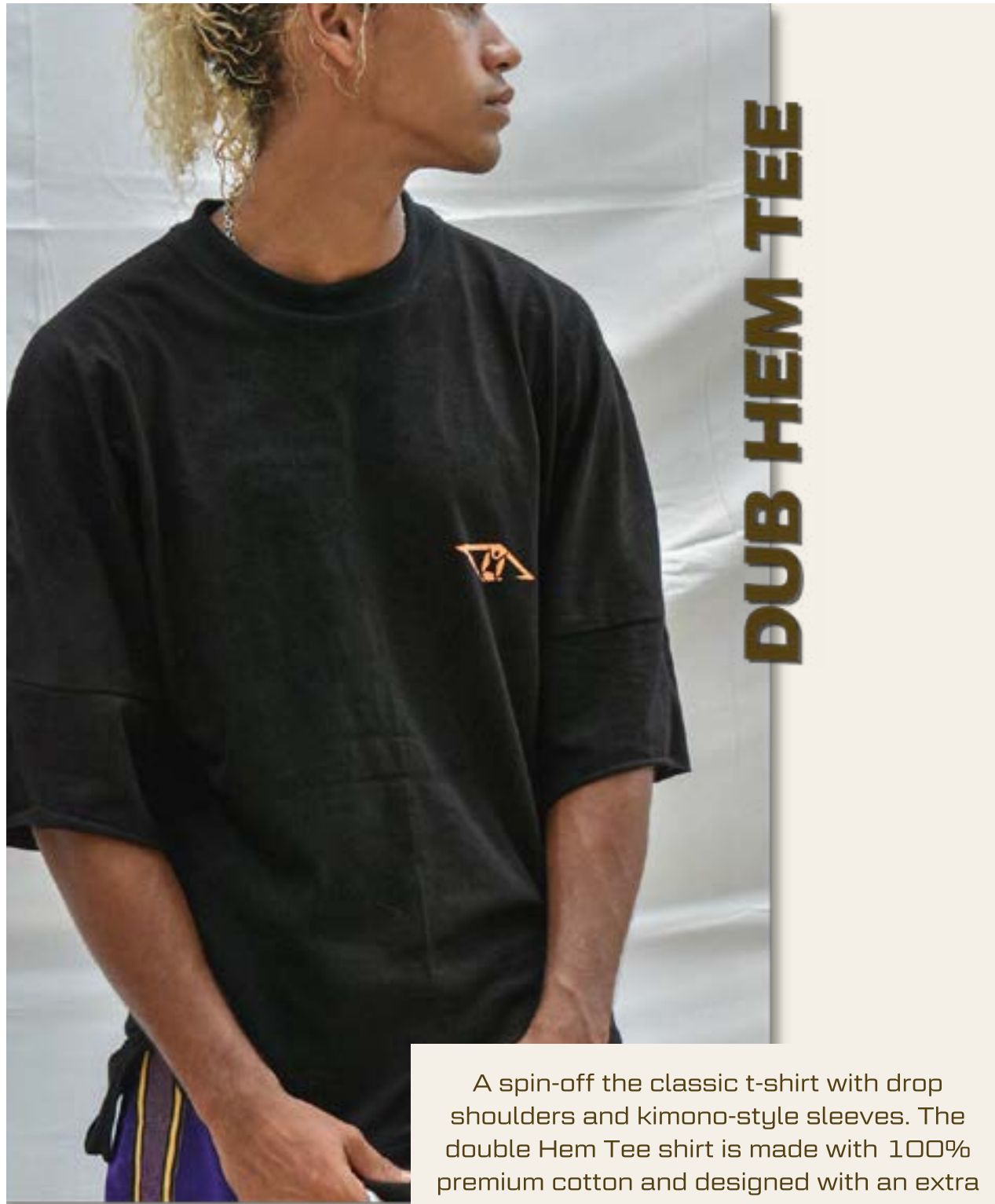
A spin-off the classic t-shirt with drop shoulders and kimono-style sleeves. The double Hem Tee shirt is made with 100% premium cotton and designed with an extra hem at each sleeve and bottom of the body to give an elongated and baggy appearance without losing its shape. Finished with the RICH Tribe "eye" rubberized logo positioned just below the left chest.

DUB HEM TEE | BLACK

DUB HEM TEE | PURPLE

DUB HEM TEE | STRIPED

DUB HEM TEE | WHITE

BBALL SHORTS

As a special tribute, the Bball Shorts are designed with your comfort and style in mind. Made with Handwoven fabric from the Philippines to serve as an accent without disregarding the functionality of the classic basketball short. It features two deep pockets and braided cotton drawstrings with gold rings.
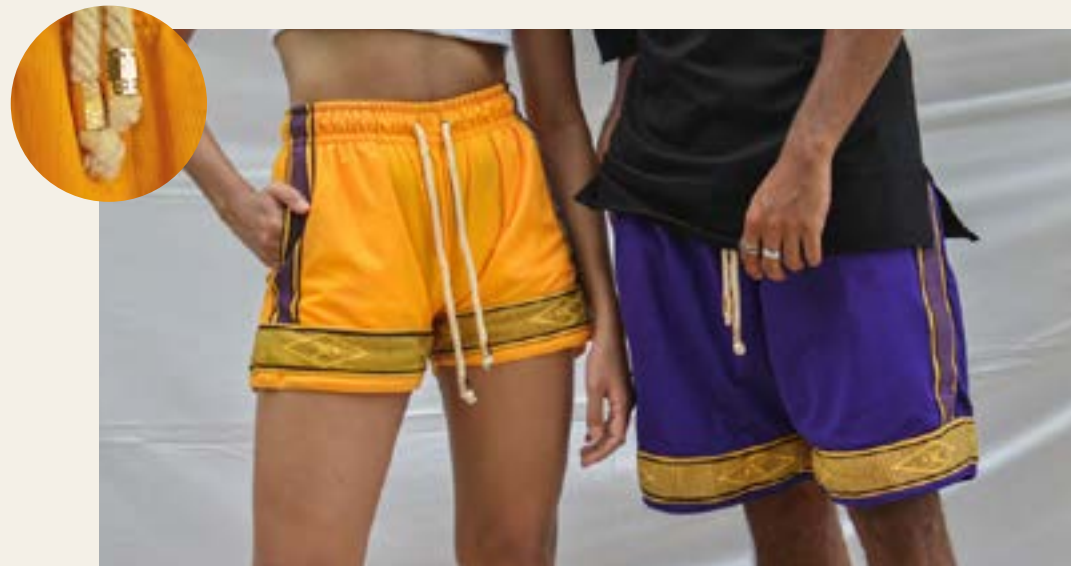
MEN BBALL SHORTS

BBALL SHORTS | MVP GOLD

BBALL SHORTS | MVP PURPLE

BBALL SHORTS | ILLA

BBALL SHORTS | WHIRLWIND

WMN BBALL SHORTS
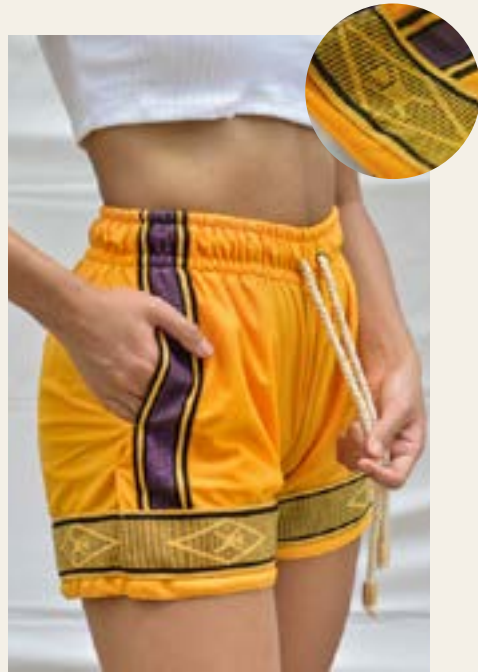
BBALL SHORTS | MVP GOLD
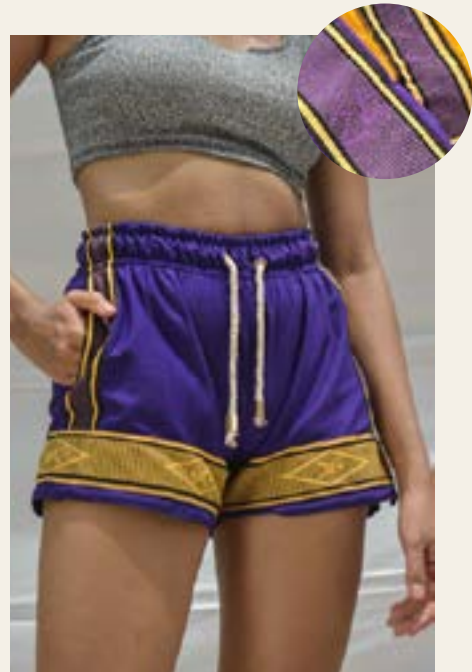
BBALL SHORTS | MVP PURPLE
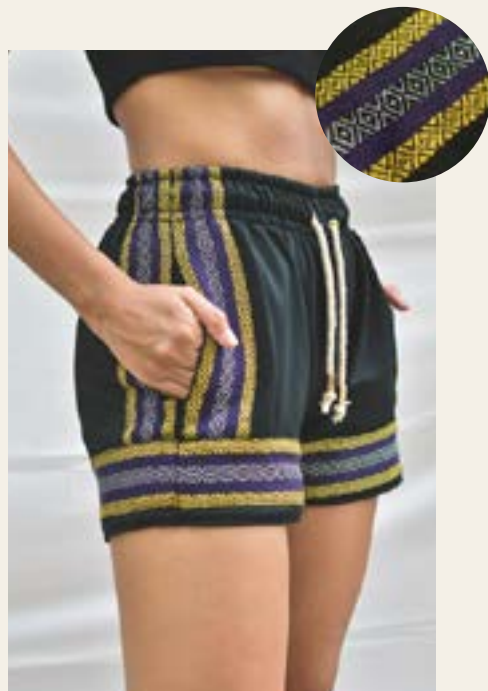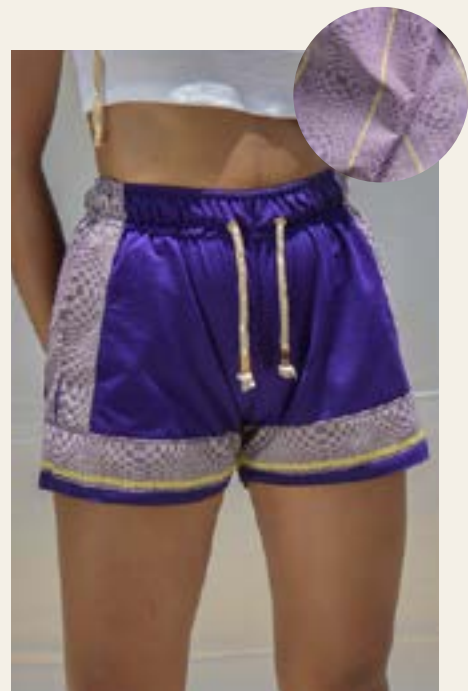
BBALL SHORTS | ILLA

BBALL SHORTS | WHIRLWIND

NOTCHED TANK

The Notched Tank is the perfect essential basic made with 100% premium 2x1 rib-knit cotton.

NOTCH TANK| BLACK
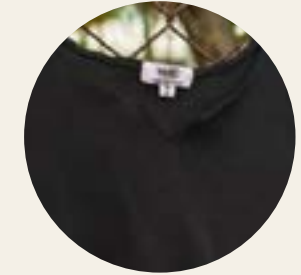
NOTCH TANK| GRAVEL
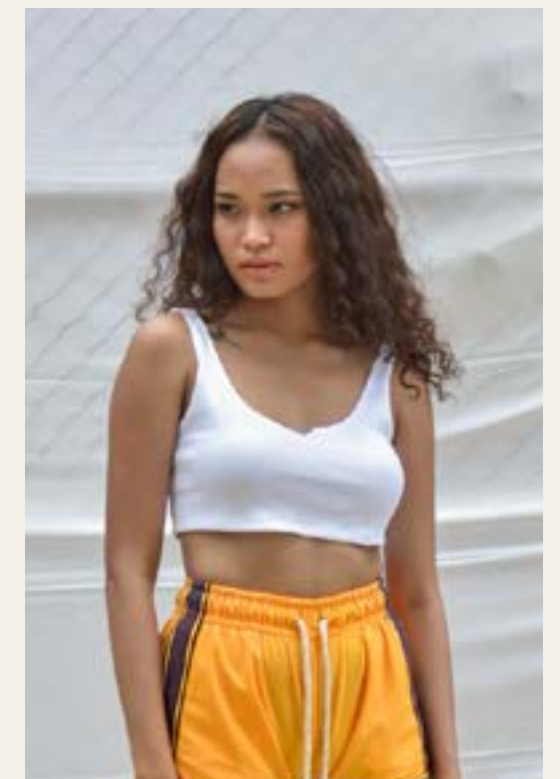
NOTCH TANK| WHITE

The "Buckets" Hat is designed with 100% twill cotton and handwoven textiles from the Philippines. Our hats are double-sided-wear/reversible, features a wider brim of 3" for extra shade, a pocket on the crown to provide storage, and removable drawstrings with gold cuffs to serve as an accent and security.

B U C K E T   H A T S

"BUCKETS" HAT | ILLA

"BUCKETS" HAT | WHIRLWIND

"BUCKETS" HAT | MATA-MATA PURPLE

"BUCKETS" HAT | MATA-MATA BLACK

LGNDSNVRDIE

S/A 2K21 CAPSULE

LGNDSNVRDIE

S/A 2K21 CAPSULE

LGNDSNVRDIE
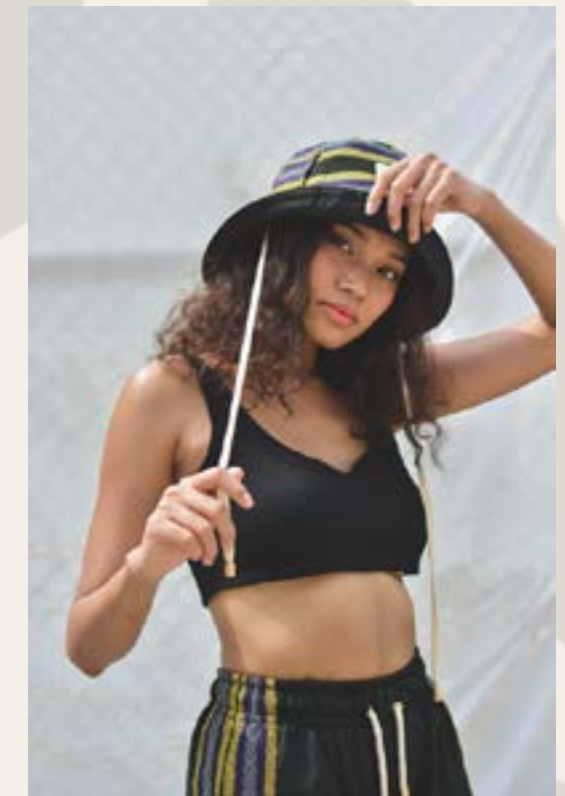
S/A 2K21 CAPSULE

LGNDSNVRDIE

S/A 2K21 CAPSULE

LGNDSNVRDIE

S/A 2K21 CAPSULE

LGNDSNVRDIE

S/A 2K21 COLLECTION

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Dizon
Abigail

Understanding the Activism and Leadership of Women in Los Angeles Chinatown: Perspectives and Experiences in Addressing Gentrification

Abstract

For generations, Chinese American people have found place and identity within the communities that have been formed in Chinatowns. This project aims to analyze the transformation and prospects for change of Los Angeles Chinatown in the context of contemporary issues such as gentrification by analyzing the perspectives of women leaders from nonprofit and community organizations that drive a sense of community in Chinatown. This project utilizes interview transcripts, collected by Dr. Laureen Hom, with female organizers in Chinatown to evaluate the patterns and variations in the context of the project. Though women community leaders view gentrification as a very nuanced subject with gray areas, there is an evident sense of urgency to protest the commodification of space in Chinatown for the sake of the community.

Introduction

After World War II, many Chinese immigrants established place and identity within the parameters of Chinatown by raising families, starting businesses, and running community organizations. The history of urban development policies and the commodification of the space in Chinatown has created the historic Chinatown in Los Angeles that exists today. While the spot may serve as a tourist destination, appealing to a variety of visitors worldwide, this paper takes a closer look at the inner workings of the community that exists in Chinatown.

Most specifically, this paper examines Chinese American women in Chinatown and how their involvement in civic engagement plays an integral role in the structural makeup of the community. However, lack of political representation, financial insecurity, and the role of gender and race have existed as barriers in the proper development in Chinatown Los Angeles. One of the most prominent contributors to this inequality is the model minority myth attached to Asian Americans. These misconceptions of Asian Americans lead to consequences such as underrepresentation, lower wages, and discrimination in the workplace and education system (Suzuki, 2002). In addition, a study done on female Chinese American church leaders revealed that there is an overwhelming lack of consideration of women's duties within community organizations such as churches. The arduous task of balancing both traditionally expected home duties and leadership roles often make such leadership opportunities unnecessarily demanding (Chen et al., 2017).

With the commodification of Chinatown space and gentrification gradually taking over affordable housing and small businesses, this paper analyzes how different Asian American women activists in Chinatown view these issues and their predictions for the future. The main research questions guiding this project is how women leaders in Chinatown organizations represent the neighborhood in gentrification issues? Drawing from interview data with women who are active in Los Angeles Chinatown community organizations, this paper considers how they may be disparately affected by race and gender norms in shaping their responses to changes in the neighborhood.

Literature Review

Importance of Asian American Nonprofit Organizations

Community-based and nonprofit organizations are integral to the development of Asian American communities. The goals of these organizations vary depending on the type of institution, however they all ultimately strive to advocate for the betterment of their fellow Asian American peers. The exponential growth of Asian American populations corresponds with the increase of the respective nonprofits. A common aspect of these groups is aiding victims of crimes such as domestic violence where they would otherwise have no other place to turn to (Chen & Nakazawa, 2017). In addition, specific nonprofits located in less affluent areas are able to help Asian American who lack the literacy skills necessary to fill out legal documents or to read foreclosure agreements (Lee & Kim, 2020).

These organizations have been able to fluctuate to different demands of the specific ethnic groups they serve. For example, Chinese American communities have set up Chinese language schools to help children hone their English literacy skills. This, as a result, helps them integrate smoothly into mainstream academia. In addition, Japanese American community organizations addressed grievances following their internment during WWII through the Japanese American Citizens League (Hung & Ong, 2012). In these organizations, it is necessary to highlight the concept of the role of emotion for Asian Americans. The researchers Chen and Nakazawa have proposed frameworks to ensure that the staff, volunteers, and board members are able to serve clients more properly and extend more of an empathetic hand when it comes to dealing with these issues (Chen & Nakazawa, 2017).

Though these nonprofit organizations have been overwhelmingly beneficial serving different ethnic enclaves and communities, they have struggled with sustainability. Research shows, however, that the two most important factors that influence whether or not an Asian American nonprofit will be sustainable are how much revenue they generate and the age of the organization. Therefore, newer organizations that lack financial management and are unable to secure funding are less likely to be able to withstand the fluctuations of the economy and general environment (Hung & Ong, 2012).

Another aspect that adds to the perpetual issue of limited funding for these overlooked organizations is the model minority myth of Asian Americans. Due to the model minority myth, many Americans have viewed Asian Americans as wealthier and more self-sufficient than their white counterparts when research has shown that this is untrue. However, this long standing stereotype has created the misconception that Asian American programs do not need financial aid or support (Suzuki, 2002). In addition, Asian American nonprofits themselves have been widely ignored by many researchers. This gap in literature has also contributed to the lack of awareness and financial support for these non profits. Only 1.5% of national foundation grants were given to Asian American organizations and less than half of 2,400 of these organizations earned a revenue over $25,000 at the end of the year (Lee & Kim, 2020). Research suggests that Asian American nonprofits should analyze behaviors of the government and private granters in order to manage their finances

more efficiently.

More political representation by Asian Americans is crucial to sustain the long term goals of different nonprofit organizations. Drawing back to the model minority myth, despite the fact that the median household income of Asian Americans has increased, political participation through different avenues whether it be voter turnout or campaign participation has not increased. In addition, Asian Americans in politics have not seen an increase despite their ever growing population. However, experts in the field have pointed out that it Asian American leaders are poorly equipped with resources to properly navigate the American political environment leading to an imbalance of Asian American voices in political debates (Chung, 2007).

Because of the lack of formal political representation, many Asian Americans were able to gain visibility in mainstream American politics through their work in nonprofit organizations. For example, relief from the social and financial pressures of immigration were delivered via the Korean Immigrant Workers' Advocate organization, a nonprofit that served as a social service and granted aid despite the barrier that comes with the lack of political representation (Chung, 2007).

Asian American Women Leadership in Nonprofits

Asian American women have also become important to nonprofit organizations. However, the existing scholarship surrounding Asian American women in positions of leadership in nonprofits suggest that their struggles derive from misogyny and lack of financial support from both private and governmental actors. Traditional Chinese morale is to satisfy domestic needs before venturing out and fulfilling other areas of their lives such as their leadership positions (Zhang, 2018). This sentiment is present in Chinese American organizations as well, making it difficult for women to go against the grain of their traditional roles in pursuit of being a proper leader. Even when these women are placed in managerial positions, they are often undermined by their male counterparts and viewed as second class workers (Zhang, 2018). Finally, there is an internal factor that inhibits Asian American women's capability to perform as leaders. In the workplace, Asian American leaders are more prone to experience feelings of insecurity and fear of failure when they are treated as subservient to men (Xie & Pang, 2018).

Seeing as religion is culturally significant to many Asian American cultures, churches play a large role in community-based organizations. A lot of Asian American women find that these places are the only organizations that even consider welcoming them as leaders. However, these women often have no voice when they want to speak out or criticize the male leaders. In addition, they are expected to efficiently juggle both domestic and ministry duties. In order to cope with the mental and physical exhaustion that comes with these expectations, women have bonded with their fellow Asian American women peers and created informal support groups to air out their grievances as they have no platform to do so otherwise (Wong et. al, 2017).

The process of Asian American women finding a proper place within nonprofit community organizations is made more difficult through dual oppression. Not only are Asian American women victims of racial issues but they, in contrast to their male counterparts, are victims of misogyny. This sexualized racism leads to Asian American women being stuck in low level jobs, leading to a lack of representation in management. In addition, racialized sexism restricts Asian American women to traditional, family oriented tasks. These women are denied resources and opportunities to advance in their education or workplace (Mukkamala & Suyemoto, n.d.).

The Gentrification and Commodification of Chinatowns

Chinatowns were a direct response to the legalized commodification of Chinese culture and were inherently created to serve the white gaze and appease tourists by creating an "authentically Chinese" environment (Naram, 2016). Westerners often held the notion that Chinese-Americans were not able to assimilate to American norms. As a result, urban planners and architects who worked on Chinatowns capitalized on the "exoticness" of Chinese culture. Fake stories of hidden dungeons, opium dens, and gambling houses coupled with facades of ingenuine pagoda styled architecture helped create the narrative that Chinatowns were legitimately authentic (Naram, 2016).

Nonprofit organizations play a crucial role in the structural makeup of ethnic enclaves such as Chinatown. Traditionally, ethnic enclaves in North America provided spaces for Asian-American immigrants to slowly assimilate to western culture without having to compromise their own culture. Chinese immigrants moved to places that already had an established and heavily concentrated Chinese-American population which made it easier for them to find jobs, housing, and insert themselves in a place of community. However, these enclaves were vulnerable to commodification and are being pushed out by means of gentrification. For example, in Chinatown in Washington D.C. the majority of the population is now non-Chinese. However, the non-Chinese people still profit off of the historical Chinatown and the remains of the Chinese allure as city planners reinforce the Chinese icons that make Chinatown so attractive to tourists (Terzano, 2014).

Through the lens of an urban planner with the intention of exploiting Chinatowns for financial profit, Chinatowns are simply vessels to promote tourism and to decorate with artificial tokens of authenticity. However, Chinatown is a complex space and home to the people who live and work there. Since the 1960s, many of the residents of Chinatowns have resisted development changes and efforts toward gentrification. They are able to do this through framing. In other words, residents of Chinatown associate their experiences and find a sense of identity within the place they live, encouraging them to resist the commodification of their space (Benford and Snow, 1974).

In the 1960s, Chinese-Americans, especially the younger generation, became more racially conscious and advocated for agency over their space in Chinatown. This is seen with the 1968 Chinese Youth Council that challenged city planners made up of merchant elites who were using anti-poverty funds to develop tourist attractions in Chinatown. Advocacy by younger generations, however, tended to clash with the older generations who grew up going along with the commodification of their culture and participating in self

orientalism. As described by the article, self orientalism required many Chinese-Americans to serve the white gaze and tourists in order to make a living. (Umbach & Wishnoff, 2008).

Historically, devoted Chinese American entrepreneurs and homeowners were instrumental in the development of Chinatowns as a community. However, the gentrification and commodification of Chinatown pushed these entrepreneurs out of their space and diminished their initial investments to the enclave. Non-Chinese elites strategically limited the funding for Chinatowns infrastructure as they did not view the area as part of their urban planning initiatives (Knapp & Vojnovic, 2013). Moving forward, it is evident that there is a need for collective action toward the improvement of living conditions for Chinese people living and working in Chinatown. However, this is not possible without the contributions of the economic elite who dominate decision making in the enclave (Nguyen, 2011).

Method

This paper utilizes a qualitative approach in order to reveal patterns and variations among female Chinese American leaders in Chinatown. Specifically, this project bases its findings on interviews conducted by faculty mentor Dr. Laureen Hom. For the purposes of proper sampling, Dr. Hom strategically selected community leaders whose organizations varied in interests ranging from residential, business, and cultural. The interviewees were explicit in their personal impressions of the transformations in Chinatown whether it be social, infrastructural, or political.

These interviews were conducted between 2016 and 2017 and for the purposes of this research project, I used a subset of 4 interviews out of the total 52 conducted. The interviewees I selected range from both the younger and older generation of community activists in Chinatown. While they are indeed active members of the community, these women have never actually lived in Chinatown. This speaks to the larger interview sample which found that only 17 out of 52 have actually resided in Chinatown. This is suggestive of the historic trend of community organizers in Chinatown living outside of the neighborhood (Kwong, 1996).

I conducted case analyses for the interviewees I selected by coding their interview transcripts into specific sections. The first section was their motivations for civic engagement in Chinatown. This included pinpointing different factors that contributed to their role as organizers including family history or certain ideologies that guided their political engagement. The next section was their perceptions of the needs of Chinatown. More specifically, I highlighted parts of the interviews where they discussed how their identity shaped their involvement and how their involvement varied from organization to organization. Finally, the last section was their perspectives of what Chinatown should be. It's overwhelmingly clear that there have been key changes to Chinatown over the years and in this section, I analyzed keywords such as gentrification in order to examine the different leader's attitudes toward the future of Chinatown.

In addition to utilizing these interviews, I also did intensive research on the topic by reviewing scholarly articles and peer reviewed journals. The research from these pieces aided the formation of my literature review and later drove the process of coding the interviews. Key topics that I looked up were the importance of Asian American nonprofits, Asian American women leadership, and the gentrification and commodification of Chinatown. While researching, I found a plethora of information that pertained not only to Chinatown but to other ethnic enclaves. I was then able to reveal patterns in Chinatowns on an international level rather than just in Los Angeles.

Findings

The objective of coding the interviews was to find major themes across the interviewees. By doing this, I was able to uncover patterns in order to create generalizations about women activism in Chinatown. The major themes I found were motivation for civic engagement, experiences with civic engagement, perspectives of what Chinatown should be, and opinions on gentrification. Seeing as I analyzed interviews from both older and younger generation actvists, there were variations in experiences that emerged. The following section will detail the major findings of this paper.

Motivation for Civic Engagement

All of the women whose interviews I've coded for the purposes of this research project have extensive educational backgrounds and share a common alma mater at the University of California, Los Angeles. Through UCLA, an older activist, gained interest in organizations such as Asian Americans for Equality (AAFE). Another older generation interviewee also began her affiliation with the Chinese Youth Council during her time at UCLA when she and her peers decided to "go back to their roots."

One of the younger generation activists was a single mother of one at the time of the interview. As a way to increase involvement in her son's education, she joined the Friends and Alumni of Castelar Elementary School (FACES) and the Parent Teacher Organization. Despite her involvement in the community, she never lived in Chinatown. However, she grew up around the area and recalls walking around, noticing some of its shortcomings. "... there were dilapidated buildings. There were certainly areas that were always empty and... there was really no interest from outsiders to walk through certain streets."

In contrast, the other younger generation woman visited Chinatown weekly with her parents. She frequented a specific temple on Yale Street and only engaged with Chinatown as a visitor, rather than a community member. It wasn't until she affiliated herself with the Chinatown Community for Equitable Development (CCED) that she started to view Chinatown as a community. "... once I got involved with CCED ... I guess all those pieces connected and I actually saw a community." One of the older generation women relates as she also grew up visiting Chinatown with her family. In fact, she cites her father as being one of the main motivating factors for her work in community organization. "As far as my work, it's ingrained in me. I have it from my father. I have his legacy."

Understandably, the interviewees had similar motivations for becoming leaders in community organizations. The people they met through the various universities they attended, including UCLA, acted as networking actors to start their involvement in growing Chinatown's community. In her interview, one of the older generation activists credits

her peers from college for introducing her to Chinatown community work. "So that's how I kind of got involved. I had friends who told me oh this is ... a good group. You should join this group." In addition, while one of the younger generation activists served a lot of time with Castelar Elementary School in order to influence decision making in her son's school, she also worked as a bilingual teacher at Castelar. She discovered her affinity for education while volunteering at schools both independently and through the CYC. More specifically, she worked with the Chinatown Education Project, a branch of the CYC. There, she ran a tutorial and enrichment program for children on Saturday afternoons. In addition, she found it easier to work with at-risk youth rather than elderly residents since, at the time, she was college aged. A good majority of people from the CEP program ended up becoming teachers. Another contributing factor that motivated the activists was outrage at different urban policies that were being implemented in Chinatown. For example, she was part of the Asian Americans for Equal Employment which began its organization after the building of the Confucius Plaza in Chinatown. "... It really resonated with people and they had huge demonstrations." In fact, many other organizations modeled themselves after the AAEF in order to advocate for equality in employment for Chinatown residents.

Perceptions of the Needs of Chinatown

Seeing as I analyzed interviews from two younger and older generation activists, their experiences organizing in Chinatown vary due to the age gap. In addition, while all interviewees shared astute insight on their background in Chinatown, the older generation activists expectedly have more dense and detailed accounts. One activist, for example, grew up in Philadelphia's Chinatown and has history both there and in Los Angeles. One of the organizations that she was involved in was the Philadelphia Chinatown Development Corporation. During the time she was involved, cities such as Philadelphia and Camden were experiencing major shutdowns of warehouses and factories. Subsequently, the PCDC worked to convert these abandoned facilities into affordable housing and senior housing complexes. She was also part of the CRA and wrote the policy for this organization. Because of her influence on the CRA, she was able to advocate for the Adelante Redevelopment Project and ensure the program worked effectively with the Project Area Committee (PAC).

While organizing in Los Angeles Chinatown is an integral part of her history as a community activist, she notes that there are key differences that make Los Angeles Chinatown stand out from the others. She found that it was more difficult to organize in Los Angeles. "New York Chinatown, a small factory is 100 workers. A small factory here is literally mom, pop, and their cousin." Therefore, she had to advocate for and work with more family based organizations. According to the older generation interviewee, the method of organization in Los Angeles was a lot less developed than the organizations based in San Francisco and New York. She also noted that there was a lack of a sense of community in Los Angeles Chinatown. She credits this to the fact that many people viewed Chinatown as a homogenous group of people. However, she notes that there was a large influx of Southeast Asian people such as Vietnamese and Cambodian immigrants into Los Angeles Chinatown in the late 70s. "... this community had to shift and learn. It wasn't just Chinese."

In her interview, an older generation activist also shed light on the pattern found in Chinatown organizations of trying to wrestle financial insecurity. For example, the CCED is currently running completely independent from any funding from the Chinatown Service Center. In addition, financial issues proved to be at its peak during the large wave of Chinese immigration in 1965 when the immigration laws were loosened. "... at that time, we didn't have anything." She discussed the fact that there was no service center, no bilingual education, and inadequate childcare. This coupled with the strenuous language barrier and another wave of Vietnamese refugees coming to Chinatown in the 70s resulted in more advocacy for these essential community centers. "So that's why there was a push ... at that time to create ... all of these ... community programs and agencies like Chinatown Service Center."

Another issue that Chinatown communities face is lack of awareness. All of the activists strongly believe in the impact residents of Chinatown have to influence political elections and urban planning decisions that affect them. One of the younger generation interviewees discussed her involvement with the CCED heavily throughout the interview. Some of her specific responsibilities include community outreach, facilitating events, and organizing social community building programs. "I definitely notice that a lot of folks don't even know what's happening in Chinatown in regards to the potential of developments coming in." She notes that one of her biggest focuses as a community activist is spreading awareness of different urban planning prospects in order to give otherwise ill-informed residents the chance to engage in the planning process. For example, many residents live in rent-controlled buildings. However, with rumors circulating that the buildings are set to be sold, the interviewee focuses on educating the residents on their tenant rights in order to alleviate any potential housing stress. In addition, she has worked with her colleagues to ensure that residents are aware that CCED is a "space that [residents] can go to if they need help around certain issues like their housing."

One of the younger generation interviewee's community organization work also involves voter outreach and tactics to raise awareness of community happenings in the political context. She worked closely with the Department of Transportation. Through this department, she was able to advocate for the revitalization of Yale St., seeing that many Castelar children needed to safely walk through the street. She is also on the land use committee for the Historical Cultural Neighborhood Council (HCNC). As part of her position, she reaches out to different organizations in Chinatown and connects them with different communities. However, she brought up the fact that there is a profound lack of representation in the council. "... during our recent election process, I found that to be problematic because there seemed to be an imbalance in some way." During the election process, she noted that many people, especially parents, were denied the opportunity to vote while many lesser involved people were able to vote. "I believe all residents should be allowed to be stakeholders."

Perspectives of What Chinatown Should Be and Gentrification

Since the end of WWII, the demographics of Chinatown have experienced significant changes. There was a large influx of women moving to these urban centers to live alongside the previously male-dominated working class society. Now, it is clear that women are

becoming increasingly prominent actors in civic engagement and community life in Chinatowns. One of the older generation interviewees discusses specific changes that she noticed throughout her extensive time in Los Angeles Chinatown. According to her, issues that the Chinatown community faces today are a lot different than the issues they faced back in the 60s. Back during the immigration wave, many people were in need of essentials. As a result, the community, while underfunded, was easily able to identify the tools they needed to support their members. In addition, since the need was so dire, it wasn't hard to rally large amounts of people to maintain community support. However, the issues Chinatown faces today are a lot more vague. Rather than worrying about how to address medical care or food needs, residents are struggling to keep up with rising rents and gentrification. It's a lot harder to "get people to see like, oh well I can move beyond this. I deserve more than this."

Supplementally, one of the younger generation activists believes that the most significant need of the community is affordable housing. "SROs are so cramped and ... the things they have access to [aren't] that great." This means that the residents of Chinatown should have equitable access to safe, quality housing even if they are low-income. She notes that this doesn't just mean building new housing but it involves taking already existing buildings that are affordable but redesigning them to make it safer and up to current housing standards. For example, she visited a single room occupancy (SRO) building in Central Plaza in order to facilitate outreach to the residents. While these housing units are affordable and accessible to the residents of Chinatown, she noticed how the quality of housing is significantly worse than the new luxury apartment buildings. "It really shows that there needs to be better quality housing units for folks."

All of the interviewees were asked to discuss their thoughts on gentrification as a potent element driving the future of Chinatown. The general consensus amongst the women was that gentrification is not a straightforward factor that is skewing Chinatown in one specific direction or another. She was also able to shed light on the prospects of gentrification not only in practice but as a term defined by the rest of the community. While her preliminary experience as an activist in Chinatown resulted in a very generic and "shallow" definition of gentrification, she has since discovered the nuances that come with the term. "... it was a very shallow definition. So it was like hip restaurants coming in." However, now she believes that "gentrification is more than just having nice things ... it's a very intentional process." To explain this, one would look at the business owners being displaced as a result of their buildings being bought out. While the definition of gentrification may involve the influx of affluent white business owners, she also points out the question of the implications of affluent East Asian people coming into Chinatowns. "... if it's more affluent East Asians coming in, is that ok or not? ... I'm still trying to figure that out..."

She also commented on the idea that Chinatown is slowly turning into a non Chinese neighborhood. While she recognizes the fact that the Chinatown area is constantly evolving, she believes that the enclave is still as vital for community development as it was before. "There are still immigrants that use Chinatown ... as a safe place to ... introduce themselves to this country."

Conclusion

It is clear that there are intersections between what I found in my literature review and the interviews that I coded. The women interviewed expressed the necessity for community aid in Chinatown. More specifically, one of the most significant areas involve civic engagement and raising awareness to the Chinatown community that their vote matters and can influence major elections. One of the most profound concepts discovered during this research project was the fact that there has been a major shift in needs from the post WWII era to the present day. As noted by one of the older generation activists, the needs of Chinatown residents are not as drastic as basic necessities like food, water, and shelter which were in high demand post WWII. Rather, another main focus of the community organizations is to tackle the gradual erosion of affordable housing in the area. While there are surely barriers for these community organizations such as financial instability and lack of political recognition, it is no doubt that these nonprofits have significantly aided the Chinatown community and will continue to support the Chinatown residents.

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**Doroteo
Natalie**   **Perceptions and experience of transit infrastructure and
                             transit-oriented development**

Abstract

Los Angeles is currently going through a massive public transportation expansion. LA metro will expand its purple (D) line to expand its route along Wilshire boulevard. This study will investigate perceptions and experiences of transit infrastructure among residents in Los Angeles neighborhoods. It will aim to understand how access to transit infrastructure has shaped or will shape their decisions on whether the extension will be a favorable amenity to their neighborhood and residents or wether it will contribute to the displacement of residents. Previous studies show that a residents's perception on transit infrastructure depends on socioeconomic status and demographic. Residents with positive perception of transit infrastructure have been low-income, immigrant, and frequent transit users compared to residents that are non-immigrant and are non transit users. The purple (D) line will be an ideal area of study as it will continue to expand upon its completion in 2028. To learn about peoples perceptions and experience of transit infrastructure we will set up interviews with residents along three of the seven stations

The Los Angeles Metro system is currently expanding its Purple (D) line, an underground light-rail project that will run under Wiltshire boulevard and will cut to through different socioeconomic neighborhoods such as Korea town and Beverly Hills. Seven new stations will be added to create a connection between downtown and the Westside. This transit project is being created with the goal of connecting busy areas and improving travel for people who live, work or visit the Los Angeles County. The Westside is the region's second largest job centers and one of Los Angeles' busiest areas. But with upgrading of neighborhoods and introduction of new transit stations we expect these changes to lead to gentrification. To understand and learn about transit- oriented development perceptions and experiences we will look at other cities and countries. We want to view areas that have dense populations that will benefit from having transit infrastructures in their neighborhoods.

In this literature review it is indicated that transit-oriented developments (TODs) can positively impact the lives of low-income and middle-income residents by improving transit access to regional amenities and work opportunities. However, despite the positive impacts, we can see how gentrification can occur when neighborhoods are upgraded and changed. Many studies aim at answering how gentrification is associated with transit-oriented developments. Some indicators of gentrification are rises in property values and rents, neighborhood investments and/or disinvestments in demographic changes. Studies have also failed to examine how race and income are variables when defining gentrification. Neighborhoods that experience upgrading, and displacement of residents is the most detrimental in low-income and /or minority neighborhoods with low housing values and no control of the land.

Review of the literature

Gentrification defined

In the United States, the ever-changing economies, demographics, and physical forms of metropolitan areas have fostered opportunity for some and hardship for others (Zuk et al., 2018). What is gentrification? Many people perceive gentrification as a racial transition of neighborhoods and an investment to infrastructure. Gentrification, a phenomenon first observed in London during the early 1960s, has traditionally described residents of higher socioeconomic status (SES) neighborhoods moving to lower SES neighborhoods (He et al., 2021). There are many definitions and factors that play a role in the process of gentrification. Depending on the time and place, gentrification has been seen as a tool, goal, outcome, or unintended consequence of revitalization process in declining neighborhoods, which are defined by their physical deterioration, concentrations of poverty, and racial segregation of people of color (Zuk et al., 2018).

Transit-oriented developments and infrastructure were built as a way to increase access to regional transportation systems, density in housing, and commercial opportunities that make those neighborhoods more attractive for investment (Sandoval, 2018). Neighborhoods that gentrified are those that have transportation systems and amenities available to residents. The link between gentrification and public investments as catalysts for neighborhood revitalization is creating a backlash against these public infrastructure transportation projects from low-income communities that fear the new investments will contribute to gentrification (Sandoval, 2018). When neighborhoods experience investments and developments residents fear possible gentrification and do not feel like their city is investing in these amenities for them.

Transit-oriented development, infrastructure and planning

Projects such as building transit-oriented developments, redeveloping existing transit or implementing new spaces have a goal in mind, to build better communities for the residents who currently live there. With investment in neighborhoods and infrastructure, follows the gentrification of neighborhoods. The planning of how and where infrastructure is built or redeveloped plays a big role in the process of gentrification. Anticipated and realized growth in property prices is also essential to fund these projects, the rate of property price change increasingly pushes land out of reach of the project budget and long-term presidents as well (Argüelles et al., 2021). The introduction of new amenities, housing and expansion of transit systems come at a price of higher property values and rent, that many long-term residents cannot afford. There is also much debate about how the redevelopment of infrastructure and planning of new developments is helping the neighborhoods in which these projects are taking place.

Do newly introduced amenities and housing cater to a certain group? In the Atlanta belt-line case study, many have opposed the planning investment of new rail lines and in which way they will expand the rail lines in. The Belt-line in Atlanta repurposes abandoned freight rail lines into a greenbelt meant for recreational purposes, the existing rail lines were left from a time in which Atlanta was a center of freight shipping, surrounded by non-intersecting, loop-like rail line (Argüelles et al., 2021). As rail lines that were once used industrially are being redeveloped, areas surrounding these stations are still underdeveloped or inadequately developed for commercial and residential purposes. Opponents argue that investment in new rail lines should service that Northeast section of the city, which is a major job center, instead of the rail center that houses the Centers for Disease prevention and Emory University, among other industries (Argüelles et al., 2021). The job center would benefit greatly from a rail line extension so that people who face long commutes are able to get to work without having to take multiple modes of transportation. If the rail line were to expand to the rail center, where there are fewer residents and fewer jobs, would prepare this area for future gentrification and allow people that can afford the new constructed housing adjacent to the belt-line and improved infrastructure to move in (Argüelles et al., 2021). Another example planning of developments and infrastructure was seen to cater to certain groups was in the expansion of the interstate system, developed primarily for white suburban dwellers to access jobs downtown, also decimated one of the city's thriving Black neighborhoods by cutting through the center of the neighborhood (Argüelles et al., 2021). Besides redeveloping current transit by expanding new lines, there are other ways we can see how gentrification could possibly take place such as introducing green spaces to a neighborhood.

Green gentrification, green spaces such as parks as drivers of gentrification, parks are a tangible urban element, as infrastructure (Argüelles et al., 2021). Green space projects are aiming to combine new transit infrastructure with the development of green spaces, reconfiguring the rail infrastructure while building urban parks. It is argued that gentrification is necessary for the development of parks in urban areas. The purchase of new, more expensive homes, from higher-income residents and their ability to provide greater tax revenue, a cause of displacement and gentrification, are embedded in the way parks are financed (Argüelles et al., 2021). Without the tax revenue provided by gentrification, green spaces in neighborhoods would not be possible since disinvested and low-income neighborhoods do not have the budget to pay and plan for green spaces. Green spaces add to the aesthetics of a neighborhood, how natural elements are integrated, and what those green spaces project to the outside (Argüelles et al., 2021). Parks are a factor in what property values could be like in a neighborhood, if the neighborhood is more aesthetic and have green open spaces, neighborhoods are more likely to attract higher-income buyers and renters. Parks have also been built in a way that should only be seen and visited instead of a place where residents can use the space physically to walk around or spend the day. Although some trees are local or regional, others were imported from Spanish locations, require different type of soil with different organic matter and construction of an aeration tube for efficient irrigation (Argüelles et al., 2021). We can see what measures cities are taking to make parks aesthetic and unique by what materials and what designs are implemented, also what it costs the city to be able to import and plant vegetation that isn't native to the area. Urban political ecology analyses of urban form and social process have stressed the ways capitalism not only produces cities but also produces nature in cities at the same time (Argüelles et al., 2021). Activists and local politicians are resisting large scale transit-induced redevelopment projects that threaten to gentrify their neighborhoods.

Relationship between TODs, neighborhood change and community development

Communities that have been redeveloped or are being invested in are the ones who experience gentrification. Gentrification comes in many forms, one being a racial transition, where neighborhoods of minority and different socio-cultural groups are being displaced by or gaining residents. In some communities, residents are losing their sense of identity with their culture as their neighborhoods experience gentrification. Because the neighborhood has gained new residents it does not necessarily mean that there will be much social interaction. Sense of community can be defined as a communities shared experience, sense of belonging, and how long people have lived in their neighborhoods. Despite increasing research on TOD-related gentrification, its social impact, particularly on the sense of community, has not been fully understood (He et al., 2021).

A study in Latino barrios in Oakland, Los Angeles, and San Diego argues that ethnic identity has helped Latinos in these barrios create meaningful spaces of participation that transformed these transit investments into community-driven projects and encouraged opportunities for community benefits (Sandoval, 2018). Barrios have developed organizations to protect their communities from large scale developments that threaten to disrupt their communities development. Barrios are latino cultural communities; the Spanish definition of barrio is neighborhood. These neighborhoods are critical case studies as they all share similar ethnic demographics and are all experiencing gentrification pressures due to the transit-oriented investments (Sandoval, 2018). These neighborhoods have a strong sense of community because they share and ethnic identity and have a connection in their neighborhood. The grassroots organizing strategies used to influence the TOD revitalization can be seen in efforts to retain public art in Mariachi Plaza in lieu of METRO'S TOD plans to tear down older buildings to construct new commercial developments (Sandoval, 2018). Public art most common in Latino communities are large murals painted in buildings in the neighborhood that represent their culture. These murals are an example of how we can see ethnic identity in a community and are targets for demolition. Community leaders and groups have fought gentrification in their neighborhoods and have tried to get investments for their neighborhood and for their residents. Activists were able to do this by pressuring city hall and the redevelopment agency to conceptualize a request proposal that would seek developers who could construct affordable housing and also bring in a latino serving supermarket (Sandoval, 2018). We can see how community members are invested in the well being in their community by protecting their ethnic identity. New residents that are moving into the barrio and do not share similar cultural demographics do not understand the cultural significance of the community. Urban planners need to reevaluate what role they are playing in transportation justice efforts and transit-oriented development projects in low-income neighborhoods in particular (Sandoval, 2018). Latino neighborhood grassroots groups organized politically and pressured city hall to create meaningful participation where the neighborhood's ethnic identity could be manifested with planning interventions in the neighborhoods (Sandoval, 2018). Although barrios were created as spaces of segregation via discriminatory urban policies, barrios are also spaces with strong levels of social capital and community-based networks, which have been used as a form of resistance (Sandoval, 2018).

Segregation patterns are also linked with the expansion of the transportation systems (Argüelles et al., 2021). Neighborhoods with growing investments in housing and open green spaces are ultimately contributing to the segregation between the socio-economic groups in the areas that are being gentrified. Many have argued that transportation and infrastructure projects are a factor in the cause of segregation in communities and especially those that are low-income and of minority populations. Throughout the 1950s and 1960s it was a common urban planning practice to build major highways that displaced thousands of low-income communities of color (Sandoval, 2018). Transit-oriented developments and infrastructure are most commonly built in low-income communities where its residents have little to no control over practices and policies in place. The freeway revolts of the 1960s should also be seen as a neighborhood resistance efforts that pushed back against large transportation infrastructure projects (Sandoval, 2018). In the civil rights movement there was much protesting and boycotting because of segregation laws put in place about who could and could not ride the transportation systems. Neighborhood cultural changes are central to understanding contemporary struggles over transportation justice (Sandoval, 2018).

Conclusion and Findings

Gentrification can have many impacts on a neighborhood, positive or negative. Transit- oriented developments and infrastructure can bring more housing and transportation systems to neighborhoods that are disinvested, to introduce affordable housing opportunities and amenities; amenities and services can promote interactions in neighborhoods. TODs can also have a negative impact on neighborhoods, they can displace current residents by increasing property values and implementing planning policies that put in place plans that effect low-income, minority neighborhoods. Despite the positive impacts, we can see how gentrification can occur when neighborhoods are upgraded and changed. Neighborhoods also experience a loss of ethnic identity and sense of community when they experience displacement. Gentrification can manifest itself through racial transitions, which can lead to segregation. The expansion of LA metro's purple (D) line is a possible factor that will bring more people to the area, therefore bring gentrification in the form of built infrastructure, future businesses and housing.

Our study will investigate and aim to understand perceptions and experiences of transit infrastructure and transit-oriented development by setting up interviews with residents who live in or work in the Los Angeles neighborhoods near the construction of the Purple (D) line. In our preliminary findings from an interview conducted with a resident from Hancock park, we found that the resident did not find the metro system to be a convenient mode of transportation. This resident lives in this high-income neighborhood that is experiencing the expansion of the Purple (D) line along Wilshire boulevard. The resident thinks that it is more convenient to get around by car than through the LA metro system because it is a faster way than having to get to a transit station and even having to take two or three other transit lines to get to their work or home. "The metro system... you use it if you need to... but its not an ideal form of transportation..." said our resident, "all of them [family members] have essentially saved up to get a car because its not an efficient system." The resident feels that there is a need for an improvement in infrastructure to be able to make it more effective to other residents in the neighborhood. Hearing that the metro system is not very effective for

this resident, that has access to a car, we can presume that it is also not very effective for people who use this mode of transportation everyday to get around and to get to work on a daily basis. Residents agree that the extension is something to look forward to but worry that the construction of these new stations will have an effect on the neighborhood. Our interviewed resident stated, "Having trains or things run through your neighborhood can be kind of destructive, it can hurt rent prices... a train or public transport can definitely facilitate gentrification." The resident also expressed that the expansion would be a beneficial investment by stating that," if we can improve the train system... by adding train stops and increasing infrastructure... it would be useful and make access easier". This interview confirmed what we saw in the literature, that transit-oriented developments and infrastructure can affect neighborhoods in a negative way such as increased rent prices and cause neighborhoods to gentrify but can also have some positive impact. To further our understandings of people's perceptions and experiences of transit infrastructure and transit-oriented development we intend to continue to gather interviewees from the neighborhoods adjacent to the purple line extension project.

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Entus Conor   **The Importance of Narrative Autonomy in the Narrative Self**

Abstract

In this essay I explain how models of the narrative self must be able to explain narrative autonomy in order for them to show how people can interact with their narratives. I present the views of Marya Schechtman, Richard Heersmink, and Sarah Lucas and show why they cannot properly address narrative autonomy. From there, I go into how narrative autonomy requires active self-reflection that creates self-knowledge that is consistent with reality and how one must have the capacity to use this knowledge in order to have narrative autonomy. Next, I explain two ways that the narrative can be changed using these methods, restructuring and active change. Then I will show how willful ignorance can be used to avoid narrative autonomy. After this, I provide three examples showing the importance of narrative autonomy and how certain human experiences need narrative autonomy to explain their existence. Finally, I present three objections that attempt to undermine the idea that narrative can be changed and whether or not self-reflection or narrative autonomy are as relevant as this paper argues they are.

Introduction

The narrative self is a model of personal identity that argues that our self consists of some sort of narrative that we create about ourselves. While there have been many different attempts to organize the idea of a narrative self, those that currently exist do not effectively show how an individual can be said to have control over their own narrative. To do that, a view must be able to explain how a person can be said to have narrative autonomy. In this essay I will argue that a conception of the narrative self must be able to explain narrative autonomy in order to properly account for the ways in which a narrative self would be experienced. Narrative autonomy is important because it shows the ways a person can actually interact with their own narrative in the context of their own environment and experiences. By explaining how these interactions can cause a narrative to change or stay the same, my argument shows how the narrative self can reflect a person's experience of understanding themselves. I will start by explaining what the narrative self is in its most basic form before providing some background on some of the views that have been created featuring the narrative self. Then, I will go into why none of these views can effectively deal with the issue of narrative autonomy. After this, I will explain my view of what narrative autonomy is and explain how active self-reflection and the application of the resulting self-knowledge provide it. After that, I will explain how people can avoid gaining narrative autonomy by being willfully ignorant of their own narratives. Next, I will show several examples that illustrate the importance of narrative autonomy and the role that self-reflection plays in allowing us to have autonomy in the first place. At this point I will address some objections that attempt to undermine the potential value of understanding and changing one's narrative and whether that is possible in any meaningful way at all.

Background and Exposition

The narrative self is a particular variation of the more common physiological continuity models of self. This model focuses on the ways in which a person remembers things rather than the memories themselves. While memory is a key component of the narrative self, it is built on the assumption that a person will not remember their whole life, and what they do remember will likely be fragmented and distorted to reflect their own views and experiences. The most important part of the narrative is the way it is shaped, structured, and understood. These are caused by a person's understanding of narrative, their own lived experiences, and the environment they live in and the stories it gives the individual. For the sake of this essay, narrative means a sort of long-term story that an individual tells about themselves that can change over time and narrative autonomy is an individual's capacity to choose to influence their narrative to either change it in some way or to decide not to change it or, in some circumstances, to maintain it.

There have been a number of different versions of the narrative self, each focusing on different parts of the narrative. Firstly, Marya Schectman's view focuses very heavily on the internal memory component of narrative. This view is based in Neo-Lockean views of identity and argues that the most important part of memory is how it is used to create an autobiographical narrative (Schectman 2012, 335). This view is also very focused on the idea of internally constructed memory as Schechtman argues that memory cannot come from outside the individual in a meaningful sense (Schectman 2011 73-74). Besides the internal focus of this view, the other major constraints are what she calls the "reality and articulation constraints" which limit what can be considered a cohesive narrative. The reality constraint demands that a narrative must conform to some basic and uncontroversial details about the world such as the fact that humans normally cannot live to be 400 or more years old. The articulation constraint demands that a person must be able to supply the local details of a narrative such as what age a person was at a point in time and basic details of their life at any given point (Schectman 2012 336). These constraints are presented as necessary because they force the narrative to be somewhat internally consistent by forcing a person to be able to paint their narrative in broad strokes in relationship to the broader world. This also prevents the narrative from being entirely fictional by forcing it to at least adhere to generally accepted ideas.

Richard Heersmink's view of the narrative, by contrast, focuses on the idea of an extended self as the principal creator of narrative. While Heersmink draws from Schectman to form a basis for his model, he rejects the idea that the narrative self can be entirely internal and focuses heavily upon the ways that memory can be influenced by and stored with external artifacts. These include the ways we can create environments that can trigger memories, remember things through our conversations and relationships with others, and record memories using things like journals (Heersmink 2016, 3137-3140). This is further expanded by his later examination of the ways that the extended self and our relations with the world around us can deeply shape our identities and narratives. In this way, Heersmink ultimately argues that the narrative self can be best understood as the heart of a network of relations that an individual is connected to (Heersmink 2018, 7). This implies that the individual has very little control over how their narrative is formed, they simply act as the convergence point of the many artifacts, relationships, and events they have experienced.

While this view does not entirely discount the role of the individual, it argues that it is not very relevant in comparison to the external factors that shape the individual's experiences and narrative.

The final view is Sarah Lucas' argument for narrative agency in the narrative self. Lucas' argument is heavily centered around the idea that the primary component of narrative construction is not the environment a person lives in, but rather, their capacity to create narratives at all, their narrative agency (Lucas 124-125). In this model, narrative agency is an individual's most basic ability to construct narratives in order to make sense of their world and their experiences with everything else following after that basic capacity (Lucas 126). No matter the individual's circumstances, a person can always be said to have narrative agency as in order for a person to be affected by their circumstances, they need the capability to create a narrative that reflects those circumstances. Lucas supports this point by arguing that no coherent view of the self can exist if it had not been created through one's narrative agency (Lucas 130-131). For example, if a person was raised in a deeply religious household, they would not be shaped by this until they had processed what was going on around them and took in the religious ideas their family was forcing upon them. At that point, they would be able to create a religious narrative about their own life that reflects their experiences. In this way, the existence of narrative agency allows for the existence of narrative identity by providing a clear origin point for narrative and showing how narrative is constructed in the first place. Additionally, the essay covers the ways in which narrative can be seen as a way for an individual to understand the nature of their own reality and how it takes information from the world around them to construct the narrative.

Why These Views are Insufficient

While each of these arguments has their strengths, none of them can effectively explain or do effectively explain how a person can be said to have narrative autonomy and therefore struggle to explain how a person can understand and live with their own narrative. Schectman and Heersmink focus on the internal and external selves respectively, but neither really seem to consider the ways in which these factors could interact in an individual's narrative. While it seems hard to deny the idea that external factors shape the narrative, by presenting the narrative self as just a hub of connections, Heersmink is not really dealing with the core premises of the narrative identity: that ultimately the individual is the one who has to make sense of their own life and create a narrative from these pieces. Schectman's view struggles in the opposite direction as her view, due to its Neo-Lockean roots, does not ever significantly address how outside factors might influence the shape of the narrative. Since both of these views focus too much on certain elements of the narrative self, neither view can adequately explain narrative autonomy.

Lucas' model is the best positioned to explain narrative autonomy, but, as far as I am aware, she has not yet explored anything like that. Instead, her work focuses primarily on the ways in which narratives are initially created. Lucas is not dealing with how a person might interact with their own narrative throughout their lives, instead, she focuses on how their narrative came to be in the first place. While this argument is an important one, it focuses heavily on establishing the groundwork for a narrative self to exist at all, rather than describing the way the narrative self persists. Instead, I will be focusing on how we interact

with already established narratives. This is what falls under narrative autonomy as opposed to narrative agency.[1]

Narrative Autonomy and the Role of Self-Reflection

Before going any further, it will be useful to differentiate narrative autonomy and narrative agency as narrative autonomy is very different from narrative agency. Narrative agency is the capacity for a person to construct and develop one's own narrative (Lucas 127). This capacity does not require any form of specific awareness of what the person is doing as the narrative construction occurs whether or not the person is intending to do it. Whenever a person is attempting to use a narrative to make sense of the world, they are using their narrative agency (Lucas 128). An example of this could be that a child could be told not to do something because they are not old enough. That child will begin constructing a narrative in their heads to justify why adults are allowed to do that thing while children are not, and in doing so, they are exercising their narrative agency likely without realizing it. By attempting to understand why one person is allowed to do things but another is not, a person is creating a story of how the world works and where they fit within it. Narrative autonomy, on the other hand, is essentially the capacity of a person to understand and modify their own narrative over time. This can happen by a person understanding why their narrative is the way it is and working to understand it in different ways, it can involve a person disliking a concept that is firmly entrenched in their narrative and working to dislodge it, it can involve a person simply using a journal to maintain a working understanding of what their narrative has been and what it could be. Narrative autonomy is not universal in scope. A person likely isn't even aware of their whole narrative because our narratives are heavily shaped by our experiences, the social norms we are exposed to, and the narrative structures we have experienced. It is nigh impossible for a person to fully understand the impact of every single one of those individual factors and, due to this, it is nigh impossible for a person to have full autonomy over their narrative. An example of this could be that a person is pursuing a career as a doctor because they were told from a young age that they should be a doctor and that they would be very good at that sort of work. Over time, the person would likely just accept the idea and might even want to be a doctor, but that does not mean that they have autonomy over the part of their narrative that is tied to their desire to be a doctor. Since that person does not understand how they were made to pursue a medical career, they lack autonomy over that part of their narrative.

While there are a variety of ways that one might be said to gain autonomy over their narrative, I argue that active self-reflection is at the heart of narrative autonomy. Active self-reflection occurs when a person intentionally attempts to understand or reevaluate their narratives. The purpose of this self-reflection could be to understand the nature of their narrative, to better understand their narrative in relation to other narratives, or to preserve one's narrative when troubling circumstances or diseases like Alzheimer's threaten to weaken one's understanding of one's own narrative. Additionally, this self-reflection must lead to genuine self-knowledge that is consistent with the way the individual's lived reality.

Additionally, this understanding must, to a certain extent, be consistent with the experiences and environments they live in to be seen as genuine self-understanding[1]. While this does not mean that the narrative of the person must perfectly match up with the narratives of all other people, it means that there must be enough overlap with some people or artifacts to ensure that there is a way for the person to understand that their narrative is accurate. The reason that some sort of consistency with the world is necessary is that just having the ability to control one's narrative does not mean that it cannot be made into a facsimile of reality where the person's own role is greatly overemphasized. In a situation where a person's narrative is not somewhat consistent with reality, the narrative is not at all consistent with reality and serves little purpose beyond acting as a reflection of how the person wishes to see themself. If a person can reflect upon their own narrative successfully to the point that they can honestly say that they have an understanding of their own narrative, they have the power to actively control it and can be said to have autonomy over it.

The final necessary component of narrative autonomy is the capacity of the individual to act upon their new self-knowledge[2]. If a person is able to learn more about themselves but, or whatever reason, cannot act upon that knowledge, they still lack autonomy. If a person comes to discover that the society they live in is deeply flawed, and that its narratives are similarly flawed, they might be aware of these flaws, but unless they can understand a way to tell the narrative in a less harmful way, they will be unable to gain autonomy. They will simply be aware of the flaws while lacking the knowledge or resources required to change their narrative in a meaningful way. If a person can manage to self-reflect to the point that they can gain self-knowledge that is consistent with their world while having the capacity to use this knowledge, they can be said to have narrative autonomy.

Active self-reflection can occur in a few different ways. The most obvious is through reframing one's narrative. We often think of narratives as going in a certain direction and having a certain ending. For example, the hero's journey is a common structure that shows the hero continuously going up against obstacles to accomplish some sort of goal. Narrative frameworks like these can easily be applied to one's own experiences. By applying these frameworks to ourselves, we also hold ourselves to the same sorts of endings these frameworks lead to, and we expect that certain steps will be followed on the way to that ending. If the framework shows someone as a failure of a person who is constantly failing to overcome the challenges they face, aren't they doomed to a miserable life? That is what some narrative frameworks might suggest. Concerns over one's own narrative progression might create motivations for a person to start reflecting upon the structure of their own narrative as they consider whether or not they are capable of succeeding in any major way or if something has been preventing them from succeeding somehow. From here, that person could potentially begin reframing their narrative to be centered less on their personal failures and more upon the circumstances that led to those failures easing their sense of guilt.

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[1] Inspired by Dr Ross
[2] Inspired by Dr Gasdaglis

Another potential way that the narrative could be altered is that the person is conscious of their past actions and attempts to use them to motivate change going forward. In this sort of scenario, there is still some reframing, but instead of changing one's view of the past to change one's view of the present, this method uses the views of the past to justify change in the present. An example of this could be a person who discovered that in the past they were abusing the people they cared about without realizing it. While this person does not attempt to restructure or justify their past actions, they still decide to change the narrative they will tell from this point onwards by accepting that their earlier narrative was tainted by the harms they were unknowingly inflicting. Over time, this person's narrative will be changed through their actions to make up for their past misdeeds and to improve their relationships with others. While this process may be complicated, by moving from a state of ignorance to a state of awareness and accountability, the narrative of the person's life will change.

The alternative to these forms of active self-reflection is willful ignorance. In this essay, a willfully ignorant person is someone who is willingly avoiding active self-reflection either. While ignorance of one's own narrative can be problematic, the most likely reason it would occur beyond willful ignorance is if the person lacks the time, energy, and mental resources to effectively engage in any form of active self-reflection. While there are plenty of people who live in situations that deprive them of these resources, the alternative is that a person has the time and energy required to self-reflect but, for whatever reason, chooses not to. By avoiding active self-reflection this person is choosing to not truly understand their own narrative and is ultimately allowing the narrative to take whatever shape it may, no matter how ludicrous or ideologically warped that shape may be. They also do not gain the ability to develop better versions of their narratives as they do not understand who they are in any meaningful way, and they do not understand how their world has influenced them. When a person makes these choices, they are willfully deciding to avoid developing self-knowledge and are actively avoiding taking responsibility for the structure of their own narratives. The difference between willful ignorance and non-willful ignorance can be seen in the differences between an isolated person and a conspiracy theorist. The isolated person does not have access to information and has few if any ways to gain information about the larger world. The conspiracy theorist on the other hand has access to the resources of society and has the potential to develop an accurate perception of the world, but instead is choosing to develop a deeply flawed perception of the world. Another example of a willfully ignorant person is someone who is repressing memories of a traumatic event because it causes them mental anguish to go over these events again. Because of this, they are refusing to reflect upon the impact their trauma had upon their narrative and who they have become. While they have the capacity to investigate these traumas due to the amount of time that has passed, they do not want to deal with the suffering that self-reflection will require and so it is easier for them to simply repress those memories and not consider how their narrative was shaped by that trauma.

Examples of Narrative Autonomy in Action

At this point, I will provide a series of examples that shows the importance of narrative autonomy to the narrative self and the role active self-reflection plays in it. The first example is a person who is simply attempting to live their life but is keeping track of their own narrative by collecting a variety of records such as emails and journals so that they can see what kind of person they actually are. This person actively wants to understand their own identity, and their curiosity and desire to generally understand themselves led to a variety of small things that help them understand their own narrative. This person might not be attempting to develop autonomy for any life changing reason, but their curiosity is sufficient to make them actively work to have a record of their life and to understand who they are in the world they live in. In this way, this person is working to gain the self-knowledge necessary to change their narrative if they feel a need to do so. While this person may not have a particular reason to attempt to gain this self-knowledge beyond curiosity, by initiating this effort, they are gaining the ability to understand how their narrative functions and what might contribute to it which allows them to do something about it if they find elements of their narrative distasteful.

The next example is of a man who came to the realization that his understanding of his own narrative was completely out of sync with how it actually existed in relation to other narratives. The short story, "The Truth of Fact, the Truth of Feeling," deals with a father who realizes over the course of the story that he constructed major parts of his narrative on a bedrock of self-deception (Chiang 25-31). This prevented him from having the sort of relationship with his daughter that he would have liked as he was convinced that she had harmed him, when in reality he had been a terrible father and she had suffered for it. The part of this that is relevant is that the man became increasingly focused on trying to understand the nature of his relationships with others so that he might be able to use his own narrative to help him interact with the world as it actually is rather than how he wanted it to be (Chiang 29-31). This event occurred after he accessed a record that proved to him that he misremembered a key moment in his relationship with his daughter. Instead of accurately remembering the fight, he had subconsciously edited the memory to make him the victim which better fit his own narrative of his life. This caused him to reflect more upon his own experiences and lead to him realizing how much of his own narrative was inaccurate (Chiang 24-26). Without the active self-reflection he underwent, he would never have realized that major parts of his own narrative were not the result of his actual actions but his narrative agency creating narratives that fit into his view of himself and the world. This scenario shows how the narrative autonomy is important because it can impact the ways we understand not just ourselves but how we exist in relation to others. If people ignore narrative autonomy and are willfully ignorant of the actions they take and the impact they have on others, they will not be aware of how they actually exist in the world. While not all such examples of willful ignorance are doomed to cause as much harm as the father did in this story, without the idea of narrative autonomy in narrative identity, there are less ways to show how people can prevent themselves from causing unintentional harm as sometimes these harms occur simply because of how the person acts based on the way they understand themselves and their world. Additionally, this example shows why narrative needs to be consistent with one's lived reality as the father's narrative was deeply flawed before he began active self-reflection. This caused him not to understand the weight of his actions and how his narrative impacted others. By engaging in active self-reflection, he not only gained control over his own narrative, but was able to change it so that his actions and his narrative would match his actions and he was able to work towards building a relationship with his daughter based in the reality of their shared experiences rather than his delusions.

The final example I will provide is of an individual who suffers from Alzheimer's and relies upon journals to keep track of their past experiences (Heersmink 2017, 1839-1840). This person's Alzheimer's has developed to the point that they have lost a significant amount of their internally stored memories, and with them, a sense of their own narrative. This person uses journaling as a way to protect their own narrative as they are able to store their memories externally in the journal and are able to use it to maintain their own understanding of their narrative despite the fact that the pieces they previously used were no longer accessible internally. Additionally, the journal helps the Alzheimer's patient maintain their narrative in such a way that it is consistent with the patient's lived reality rather than being a cobbled together concept created from whatever bits of memory the person could find. Without the idea of narrative autonomy, this kind of action would not be as easily explained as it would, at best, just fall under a different form of memory storage. This description does not entirely fit as by using the journal in this way, the person is doing more than just attempting to record random pieces of information, they are attempting to create a map that will allow them to rebuild their sense of their own narrative even if they have lost a large portion of their own internal memories. In this way, it goes beyond simple memory storage because of the ways in which the person interacts with these stored memories to repeatedly rebuilt their narrative. By understanding this as more than just memory storage and as a form of narrative autonomy, it is possible to see the significance of this action and how it stands out as different than just setting an alarm to prevent one from accomplishing a random task.

Collectively, these examples each show ways in which the idea of narrative autonomy can help show the ways in which people interact with their own narratives and why narrative autonomy matters for narrative identity. Whether it is like the casual recorder who simply wishes to better understand themselves, the father who desperately wishes to understand how his narrative interacts with reality, or the Alzheimer's patient who wishes to maintain their understanding of themselves, all of these characters are attempting to actively interact with their narratives in some way. These are experiences that narrative identity cannot cover if it does not incorporate the idea of narrative autonomy. Without that concept, narrative identity can only deal with the formation and persistence of narrative, not the ways in which people can interact with and change it over time. These examples show why these interactions matter, and why any model of narrative identity needs to have access to the idea of narrative autonomy to properly account for them.

Additionally, these all show how the narrative can interact with both internal and external factors to aid in the construction of the narrative and how autonomy can't exist without all of these factors. The father's concerns with his narrative are centered around how the narrative he constructed for himself does not connect well to the lived realities of those he cares about. Similarly, the Alzheimer's patient and the recorder are using various artifacts to either record memories to be accessed later or are trying to connect to memories imprinted in other things. In these ways, they are trying to use the outer world to influence their memories and their knowledge of their own narrative.

Objections

The first objection that I will address deals with the question of whether or not we can change our narratives in any meaningful way. This objection focuses on the idea that the very structures of the narratives we use are ultimately shaped by society, and that there are no real ways we can escape them. Our very concepts of narrative are shaped by social structures, and our capacity to understand ourselves only really can occur through the lenses set up by the larger social world (Lucas 130). Additionally, the narrative itself is a thing that consists of memories and past reactions to things, things we have little ability to control. While we may be able to change the way we understand it through action or reframing, that doesn't seem to imply that we are capable of changing the narrative itself.

My response to this is that while it is true that we cannot entirely escape the confines of our own lived experiences and the limits placed on our narratives by preexisting limits on narrative structure, that does not mean we lack the ability to change our narratives. By understanding our own narratives, we can actively take actions in the future that differ from the patterns of the narrative thereby taking control of our own story rather than allowing it to be written by the larger world for us. If the limiting factors are social structures, then a person can take actions to defy or only partially engage in those social structures as well as take actions that might bring about change on at least a local level. Additionally, by developing an understanding of our own narratives, we gain the autonomy to change the ways in which we view our own narratives and in this way restructure and reshape our narratives to better fit what we want our narratives to be. We might have our narrative structures influenced by the outside world, but that does not necessarily mean that we lack autonomy. Also, while an individual's narrative is heavily shaped by the narratives of society, it is also possible for people to oppose those larger narratives and attempt to create new ones to replace them. An example of this is the common narrative that certain racial groups have certain inherent traits, a narrative that is used specifically to target and oppress non-white groups. While that narrative is common in society, it is possible for people to come up with less racist or anti-racist narratives to use instead. In this way, the structures of social narratives can be interacted with by individuals. To suggest that an individual's narrative is entirely determined by the past is to the ways in which it can evolve and to ignore the ways in which people can ignore or defy established narratives.

The next objection I will address is that this essay is overstating the importance of narrative autonomy by arguing arguments for the narrative self need to be able to account for it in order to explain certain human experiences. While narrative autonomy might be useful for explaining how certain versions of the narrative self might explain people interacting with their narratives, it is a bit of a stretch to say that all narrative identities must use this model. Some views of the narrative self might be a purely abstract concept, and in those sections is it really necessary to bring in this specific way the narrative self could potentially be applied to an individual's lived experiences.

My reply to this is that any view of the self must be able to address the concepts narrative autonomy brings up. While theoretical analyses of the self are useful, the purpose of these remains ultimately to explore and understand the structure of the lived human self, and if no effort is put into understanding how a given theory would interact with a lived

human experience the theory is far less useful. Narrative autonomy works to explain the ways in which we interact with our own narratives. Models of the narrative self ultimately serve to explain the nature of the self, and so if they cannot explain the ways in which we can interact with our own narratives, they fail to explain a significant part of the human experience. By explaining how narrative autonomy and the role of active self-reflection would play a role in their explanation of the self, a narrative self model is better equipped to show how a person would be able to exist within the confines the model establishes.

The final objection I will address is the question of whether or not the importance of self-reflection is overstated in this model of narrative autonomy[3]. While active self-reflection may be an important part of autonomy in its ability to allow a person to learn about the narrative in the first place, does a person really have the ability to change their narrative without other factors to assist in the manipulation of the narrative? Narratives are often created creatively, so is creativity needed to effectively have autonomy and the capacity to actually change the narrative?

My response to this is that, while factors such as creativity can be used to allow a person to change their narratives in some ways, they are not universally necessary for a person to shape their own narrative. A person with a minimal amount of creativity will likely have been exposed to enough stories that, if nothing else, they are capable of applying one of the other stories they heard to their own lives in order to successfully change their own narrative in some way. While some attempts to gain autonomy may benefit from creativity or some other factor, none of these other factors are required universally. What the active self-reflection model does is present the bare minimum in terms of relevant factors, self-reflection, the gaining of self-knowledge consistent with reality from that reflection and the capacity to choose to apply it or not apply it. While it is possible specific instances may be influenced by other factors or may require outside assistance to succeed, no other requirements seem to be universal.

Conclusion

Ultimately, narrative autonomy is a concept that needs to be addressed in views of narrative identity because by ignoring it an author does not address how people are capable of actively interacting with the narrative in their day-to-day lives. At this moment, it seems that narrative autonomy requires both active self-reflection, for that self-reflection to be consistent with the person's lived experiences, and the capacity to use the resulting self-knowledge to impact one's narrative to ensure that a person can interact with and change their own narratives. Without these factors, it is hard to see how a person can understand their narrative in relationship to the larger social and environmental factors surrounding it while having the capacity to actively change or maintain the narrative.

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[3] Inspired by Dr Gasdaglis

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Socio-economic demographics and accessibility to Farmer's Mark

Abstract

Farmer's markets have grown since the early 2000s as locations for community development and for small businesses to participate in local spaces. This study will examine the locations of farmer's markets and the accessibility to various socioeconomic groups by use of data from markets, farms, and the US Census Bureau to determine spatially comparative differences. Small markets are sources essential for low-income communities, yet economic and cultural factors stimulate areas for growth in all areas of California. There is little known about the barriers to California farmer's markets creating more positive shopping habits and community experiences for low-income consumers and people of color. This study will examine ways that farmers' markets are less visited, and therefore less accessible to low-income households in need of fresh produce. Previous research has shown that low-income participants have found barriers for Supplemental Nutrition Assistance Program (SNAP) participants, user compatibility, supermarket competition, and diffident guarantee for fresh produce. This research uses Geographic Information Systems (GIS) to spatially map, visualize and examine census demographics such as median household income, race, and ethnicity to find the most statistically significant differences between six California counties.

Introduction

Research has shown there are socioeconomic disparities between cities to determine inequalities such as health outcomes, institutional, and physical characteristics of neighborhoods (Engstorm, et al. 2013). Among these inequalities are the growing disparities of food insecurity. Food insecurity can range anywhere from marginal, low, to very low, where residents report some or multiple indications of disrupted eating patterns (USDA 2022). Various communities of varying social characteristics are all affected by conditions such as socioeconomic status, family structure, life cycle, residential stability, and ethnic composition (Fairbanks 2021).

California has over 750 certified farmer's markets and are seen as locations of gathering for communities and have opportunities for local businesses and farmers to sell directly to consumers since the early 2000s (CDFA 2022). The California Agricultural Statistic Review for 2019-2020 determined California's agriculture exports to account for approximately $21.7 billion and leads the nation in fruits, nuts, and vegetable crop production (CDFA 2020). Despite the staggering agriculture industry, one out of five Californians faces food insecurity every day (CA Food Banks 2020).

Small markets are sources essential for low-income communities, however, the economic and cultural factors stimulate areas for growth in all areas of California. Programs such as CalFresh, the federal assistance program for low-income Californians under the Supplemental Nutrition Assistance Program (SNAP), are eligible to use Electronic Benefits Transfer (EBT) at authorized retailers. In March 2022, out of its almost 40 million residents, 4,343,8677 people in California received SNAP benefits (CDSS 2022). However, studies have shown that residents in urban, wealthier communities are more likely to shop at FMs for fruits and vegetables (Kelley 2022). An individual's access to food stores and fast-food restaurants may play a part in determining overall preferences and choices to shop at small, local markets.

As policy changes began to assist insecure residents, beneficiaries' enrollment increased, due to support for elderly and disabled adults (Wang et al, 2021). Residents wh o qualify and take advantage of benefits can lead an improved quality of life. Various resources funded by private and public programs can steer families receiving multiple types of support to continued employment, mitigate poverty, and lower rates of obesity for all ages (Danielson and Tan 2020, Waters-Boots 2015). Low enrollment in government programs can lead to tax money and benefits unclaimed, however, improved regional access to welfare programs can, in turn, support local states' economies (Water-Boots 2015). By establishing EBT's context in potentially reducing food insecurity, we can consider its impact on counties that face higher systematic barriers.

Since the start of the coronavirus pandemic, in June 2020 the 4.8 million beneficiaries of   CalFresh received an average of $166 monthly, which was an increase from the 4.1 million residents in January 2020 (Danielson and Tan 2020). This study will compare six California counties to examine the locations of farmer's markets by the use of data from certified farmer's markets, farms, and census data to determine comparative qualitative data. This study aims to study objectives assessing the health equity of various demographics of different California counties.

Literature Review

Why are farmer's markets important?

Farmer's markets are temporary locations, often in the form where vendors gather to sell fresh fruits, vegetables, and other products to local residents. Markets are places of communities where social events can provide educational opportunities for children, where farmers sell their products, and are places of gathering (Woodard 2004). Farmers are able to communicate directly with consumers and incorporate in-demand fresh ingredients and localized commodities into diets. Consumers who shop at farmers' markets support the local economy, food systems, and the environment by purchasing products from small business owners (Wang 2014). Many low-income participants have found the inconvenience, cost, and need for shelf-life desirable over nutritiously dense or fresh produce, but research shows that access to health and affordable markets can increase healthier selections of food and are needed in places that are not readily available (Montri 2012, Wetherill 2015). Research has found market organizers should recruit local, non-financially motivated farmers to sell in low-income, urban areas, and partnering with local governments and nonprofits may improve the equity of health (Jones 2011, Montri 2012).

Accessibility

Literature has revealed variables influencing attractive factors which include: EBT Point of Sale Devices, competition with supermarkets, rural residents' distance to FMs, less variety, and higher costs at FMs. These are ways that FM is maybe less visited, and therefore less accessible to low-income participants wanting to use EBT. Inaccessibility to EBT creates higher barriers for low-income participants, which therefore limits the consumers' knowledge regarding the locations of FMs, option to use EBT cards, and distance from supermarkets all act as barriers to access for SNAP participants.

Electronic Benefits Transfer

As an electronic system, EBT allows a Supplemental Nutrition Assistance Program (SNAP) participant to pay for food using monthly benefits to assist low-income households. CalFresh, federally known as SNAP, is California's food benefits program for low-income residents. According to the USDA, in 2017 $6.33 billion was issued in SNAP for the 3,949,512 monthly participants. EBT allows SNAP participants to pay for food using their electronic benefits in authorized retail stores (USDA 2022). To qualify, participants must meet gross and net income limits depending on the household size and then are issued a maximum monthly allotment (USDA 2021). SNAP is available in all US states and territories and benefits only U.S. citizens and certain lawfully present non-citizens. Increasing regional access to foodscapes is a multifaceted issue, involving more than increasing supermarket accessibility in food deserts.

Evidence suggests some farmer's markets discontinued accepting food stamps from the paper to electronic transition requiring vendors to obtain a point of sale device, which many open-air markets and financial burdens restrict farmers from doing so (Montri 2012). The participant's limited knowledge of EBT acceptance at FM's is also a perceived barrier for EBT recipients, which limits their market availability, if any (Ritter 2019).

Unaware of Benefits and User Compatibility

Many Americans are unaware of EBT benefits at FMs and are deterred by the complexity. With many market managers unable to process EBT, shoppers face structural barriers of limited accessibility as low-income Americans despite farmer's markets' national popularity increasing (Jones 2011). In a 2017 spatial study, knowledgeable FM shoppers were found twice as likely to visit a market near their residence, however, 59.2% of participants were not aware they lived within a one-mile distance from an FM (Freedman 2017). The aesthetic of the markets often contrasts with the characteristics of a SNAP participant. No specific race or ethnicity was found to be vulnerable in any state across any literature, just low-income residents; however, minority groups were found to be influenced by cultural and segregation barriers in community FMs where socio-economically higher consumers influence design and operation (Wetherill 2015). In a focus group, participants reveal emerging themes that FMs do not meet cultural preferences or upbringing, suggesting residential segregation and cultural barriers may be factored in why markets are not popular with minority or low-income residents (citation?).

Function

Supermarket Competition- Location

Research has shown rural residents are more likely to travel farther for local outlets. Locations of FMs may provide little benefit for urban communities due to supermarket accessibility and unfamiliarity of locations, which often operate seasonally or have fewer hours and days than outlet market chains (Wetherill 2015, Shi 2016, Buchthal 2018). The inconvenience of locations is often reported as a perceived barrier for all consumers and does not fulfill the lifestyle needs of a single outlet (Ritter 2019, Wetherill 2015). However, research has shown that strategically placing ease of access to FMs can increase the possibility of residents receiving access to healthy foods (Lucan 2015, Buchthal 2018). A study comparing rural North Carolina to New York City residents found that urban shoppers purchased more varieties and spent more money on fruits and vegetables at the farmers' market (Kelley et. al 2022).

Less-Common Products

Among the inconvenience of locations, FM's also often carry less-common produce than supermarkets but may be more expensive, leading consumers to afford fewer products. (Lucan 2015, Buchthal 2018, Ritter 2019). Some markets do not guarantee fresh produce, either, and feature refined or processed products; however, FM fruits are known to be picked within one or two days of being offered (Lucan 2015). Inconsistency and incompatibility of eating habits have been shown to prevent customers from shopping at FMs (Wetherill 2015). In a research study using a focus group to identify Perceived Accessibility Barriers for SNAP Consumers in Urban Oklahoma, Wetherill et al. found while some participants are attracted to FMs for their colorful seasonal produce, low-income participants were found to rely more on canned and frozen vegetables (Wetherill 2015).

County Reasonings

There are 58 counties in California but vary in size, population, commodities, and culture. The counties chosen were determined based on the diversity wanted prominent in agricultural sales, acres, or population, yet could be comparable across the state. All of the counties I have chosen contribute greatly to California's economic, cultural, and agricultural identities.

Fresno County is number one in California's agriculture sales, followed by Kern county who produced 9% of state sales in 2019 (CDFA 2020). These counties were chosen for their percentages of sales and similarities in top commodities: grapes, pistachios, and almonds. While Kern county is considered a part of Southern California, Fresno is located in the central San Joaquin Valley, creating geographic differences between the two. Although both counties have a similar number of FMs, Fresno has over 3,000 more farms.

Monterey is fourth in the state in agriculture sales and has more diversity in its top commodities of strawberries, lettuce, and broccoli. Located on the Monterey Peninsula, the county exhibits climate diversity Although there are fewer farms in Monterrey, there are

more FMs in the county in comparison to the highest producing counties despite only being 70,400 acres. Ventura is another coastal county but is 11th in agriculture sales in California. The top-selling products include strawberries, celery, lemons, and raspberries, which diversify California's agricultural outputs. The amount of FMs is similar to Monterrey despite Ventura having double the amount of acres and farms.

Although there are only four certified FMs in Napa, the county has 700 more farms than Monterrey on fewer acres. Napa was chosen due to its place as 16th in California agriculture sales and its niche top commodities are wine grapes, cattle and calves, and miscellaneous livestock products, which differ distinctly from any of the other counties. The California wine industry emerged as a successful region, with an identity closely associated with Napa Valley, California for making top-tier wines (Christensen 2015). As an urban hub in Southern California, Los Angeles is the most populated county in California with 10 million residents. There are a comparable number of farms to the other counties, yet has 125 FMs across its 2,613,120 acres. Most of the county's top agricultural outputs are nursery products or field crops: fruit, vine, nut, or unspecified.

County	Farms	Farmer's Markets	County (Acres)	Farm Land (Acres)	Farmland in county (%)	County Population	EBT participation by county	EBT participant by county (%)
Fresno (1)	4,774	8	3,847,040	1,646,540	42.80%	1,008,654	218,011	21.60%
Kern (2)	1,731	10	5,223,040	2,295,497	43.90%	909,235	115,449	12.70%
Monterrey (4)	1,104	15	2,413,440	1,340,142	55.50%	439,035	45,929	10.50%
Ventura (11)	2,135	13	1,198,779	260,102	21.70%	843,843	66,040	7.80%
Napa (16)	1,866	4	506,000	255,778	44.60%	138,019	7,524	5.40%
Los Angeles (35)	1,305	125	2,613,120	57,809	2.20%	10,014,009	1,371,231	13.70%

Methods

To measure the impact of my research, I am using a theoretical framework of critical geography to examine social norms, challenge the problem, and discuss where change could begin. I am seeking the social relations between locations of FMs and demographics presented as quantitative data. This research uses Geographic Information Systems to map and examine census demographics such as median income, and race or ethnicity to find visual and data discrepancy between counties. The use of geographic visualization to create spatial patterns can make problems visible and reveal unknown geographies. Data on these measures for each market were collected using the California Department of Food and Agriculture (CDFA) list of Certified California Farmers Markets. The FMs used in the data set are certified by the state of California and each market only hosts certified producers. This study conducted a test of difference to analyze demographic data consisting of household income, ethnicity, and race to collect quantitative data.

Data Collection (*Participants and Recruitment*)

The data is gathered from public data provided by various federal and state governments, such as the U.S Census Bureau data, the California Department of Food and Agriculture, and other public databases to understand the context of farmers' markets in southern California. All farmer's markets located in the six counties were obtained from

the list of Certified Farmers Markets Directory from the CDFA. Markets that are run year-round versus seasonal are identified separately to identify accessibility. Addresses were crossed-referenced for hours of operations and confirmation of the locations of farmer's markets and supermarkets. A GIS address locator and shapefile were then developed to map the locations as point data.

GIS spatial analysis was performed to identify county demographics and the number of competing farmer's market venues in each area. The income, ethnicity, and race maps were created using the American Community Survey's (ACS) 2019 Median Household income and Median Race and Ethnicity obtained through ESRI's Living Atlas. The ACS data contains 5-year data, estimates, and margins of error to compare census tract data within the county. Spatial analysis was performed using ESRI's geospatial processing program, ArcGIS PRO version (ArcGIS Pro 2.8.6) (ESRI, Redlands CA).

Data for the test of differences were obtained from the ACS 2019 Median Household income and Median Race and Ethnicity per county census tracts. This was performed to analyze what census tracts FMs tend to locate in. Urban and farmland data was collected from the United States Census of Agriculture. The Census of Agriculture's data is collected every five years and serves as a complete count of U.S. farms and ranches and the people who operate them. Finally, EBT participants by county were recorded from the CalFresh Data Board provided by the California Department of Social Services. This data was compared to analyze which counties were most in need of increased access to fresh produce.

Results (*Data Analysis*)

Median Household Income, Race, and ethnicity data were recorded in an Excel spreadsheet. A simple test of difference was performed to compare county demographics to determine where and what farmer's markets are providing to various communities.

Median Household Income (graphs)
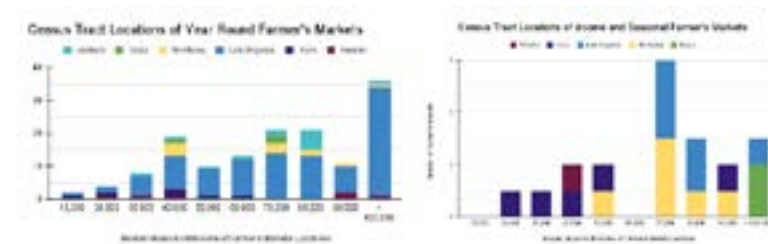
Median Race and Ethnicity (graphs)
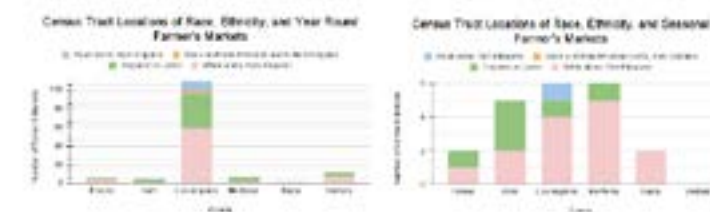
For year-round farmer's markets, 25% of the locations were in census tracts with median household incomes over $100,000, due to Los Angeles' extreme outliers of locations. Overall, 61.8% of markets are located in census tracts with a median household income of over $70,000. According to the United States Census Bureau, the median household income in California is $78,672, yet the cost of living varies from county to county (USCB 2020). Seasonal markets show similar patterns as 70% of the FMs are also located in census tracts where the median household income is over $70,000. There are no markets located in the $60,000 bracket, which indicates there is a large gap in accessibility for lower-income residents who the farmer's markets are serving. 53% of year-round markets are located in census tracts where the race and ethnicity are predominantly White alone, Non-Hispanic, while another 36% serve locations of Hispanic or Latino serving populations. This only leaves 8% of the counties' populations serving Black or Asian communities.
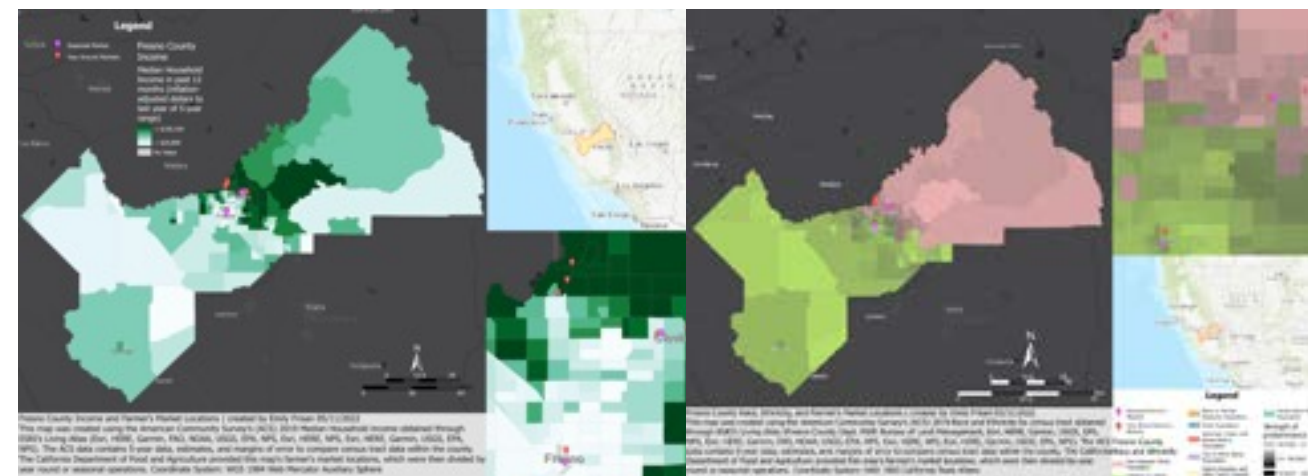
Fresno County had 50% of the year-round locations in census tracts where households make a median income of $49,000 or less. However, all of their markets are located in or around urban cities where the cost of living is higher. Similarly, the seasonal markets are located near urban cities where the income is lower than their year-round markets allowing them to serve a larger community of residents. Fresno's markets are located in binomial census tracts of White or Hispanic households. Only 38% of all the combined year-round and seasonal markets are located in Hispanic communities, as shown in the spatial divide between White and Hispanic communities.
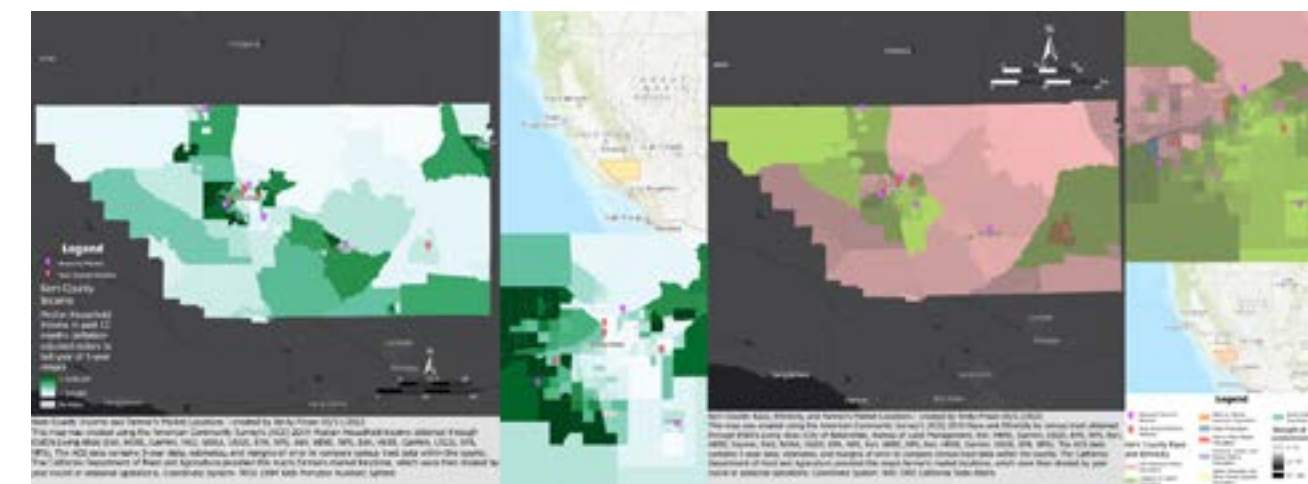
Similarly, a majority of Kern County's markets are located in urban locations. The markets are not as densely packed as Fresno County and are spatially spread over various urban cities in the county. 80% of the seasonal markets are also located in census tracts where the median household income makes less than $59,000. Despite Kern and Fresno counties having similar race and ethnicity demographics, 80% of Kern's year-round markets are located in Hispanic or Latino dominant census tracts.
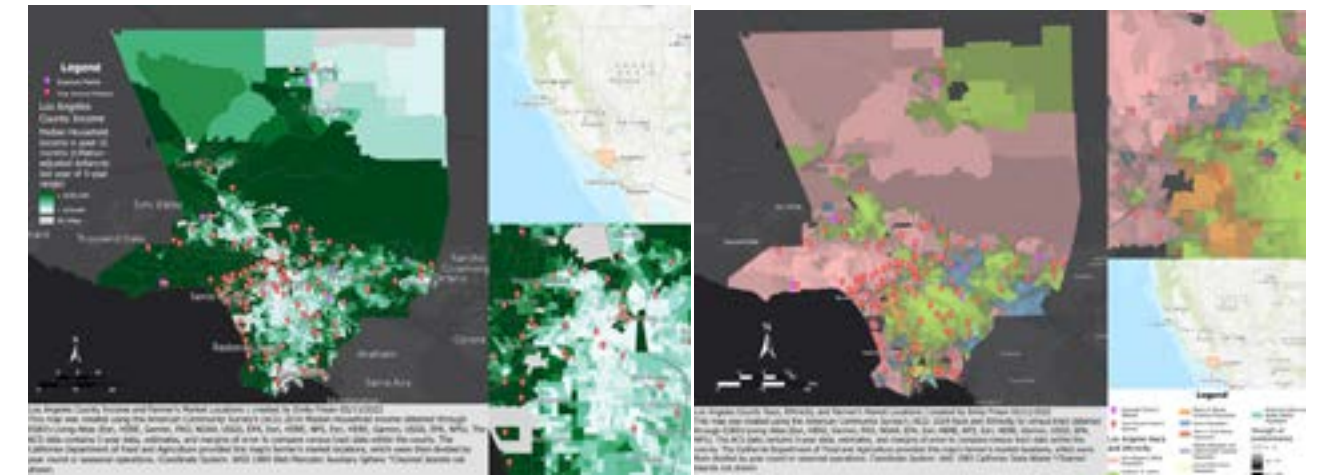
In a drastically different county, Los Angeles County contains the highest number of year-round (106) and seasonal markets (6). 64.1% of the year-round markets are located in locations with a median household income of over $70,000. Likewise, the seasonal markets have a similar pattern to the year- round markets as 100% of their locations are in census tracts with a median income higher than $70,000. Spatially, the locations of farmer's markets tend to border where the income begins to increase sharply, typically in and around coastal cities. Los Angeles County is also the only county to serve other races and ethnicities besides Hispanic or White census tract locations. However, it is important to consider that Los Angeles also had the highest diversity in residents overall in comparison to Napa and Fresno counties where there are significantly fewer Black and Asian residents. Despite a large amount of diversity, 53% of the farmer's markets in Los Angeles County are located in predominantly White census tract locations. Many of the locations where the income is higher, is also where a majority of the White residents are spatially represented.
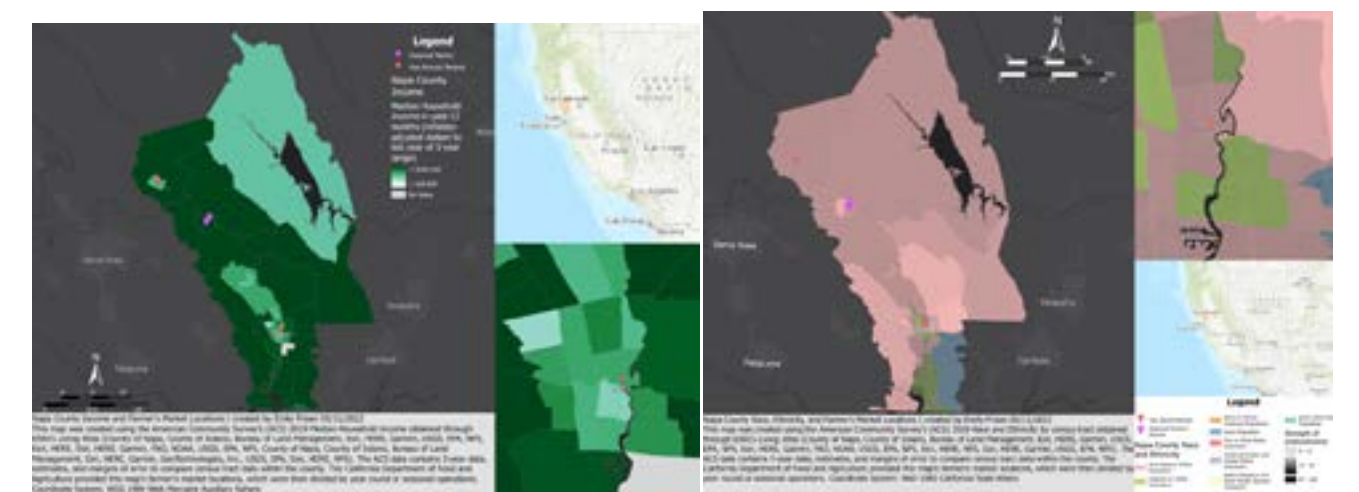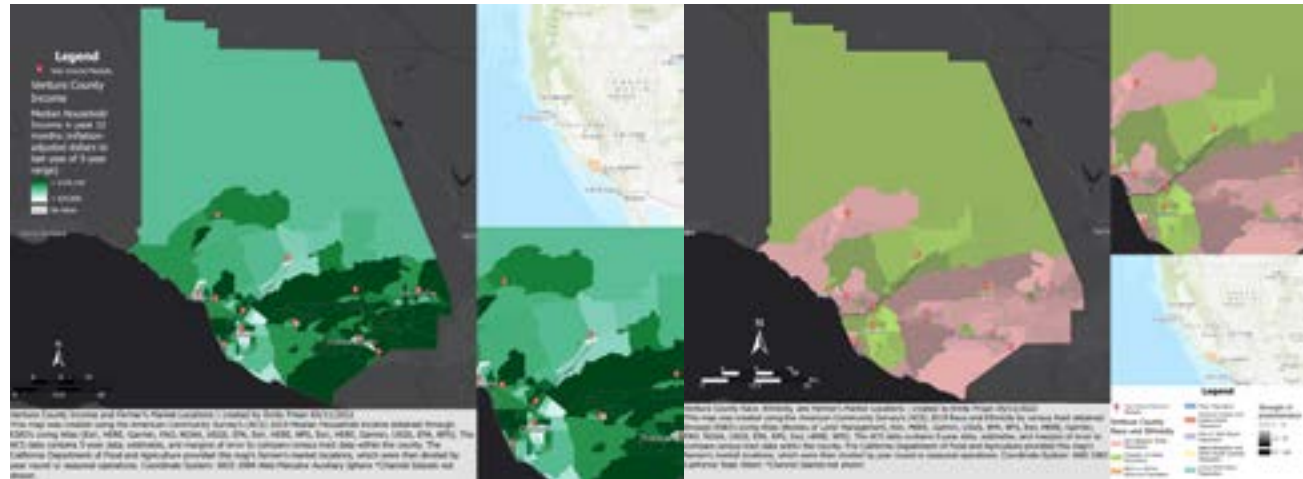
Ventura and Monterey Counties both appear to have similar patterns. Although Ventura appears to spatially serve the greatest range of household incomes, only 30% of year-round markets fall in census tract incomes where the median income is $69,000 or less. Monterey County has 64% of its year-round markets in locations where the median household income makes over $70,000 a year. Comparably, the seasonal markets show a similar pattern as 6/7 of the locations for seasonal markets are in census tracts with a household income over $70,000. However, Ventura County has no seasonal markets which allow their markets to serve residents all year long. Both counties show similar spatial patterns as Los Angeles County where a majority of their markets are pulled towards the coast, yet Monterey County has a similar pattern to Kern and Fresno counties where a majority of their markets are located in urban cities. In Monterey, only 28.5% of FMs were located in white census tracts for year-round markets, yet was the opposite for their seasonal markets, where 83.3% are located in non-Hispanic locations, in comparison to Ventura where 33.3% of markets were in Hispanic census tracts.
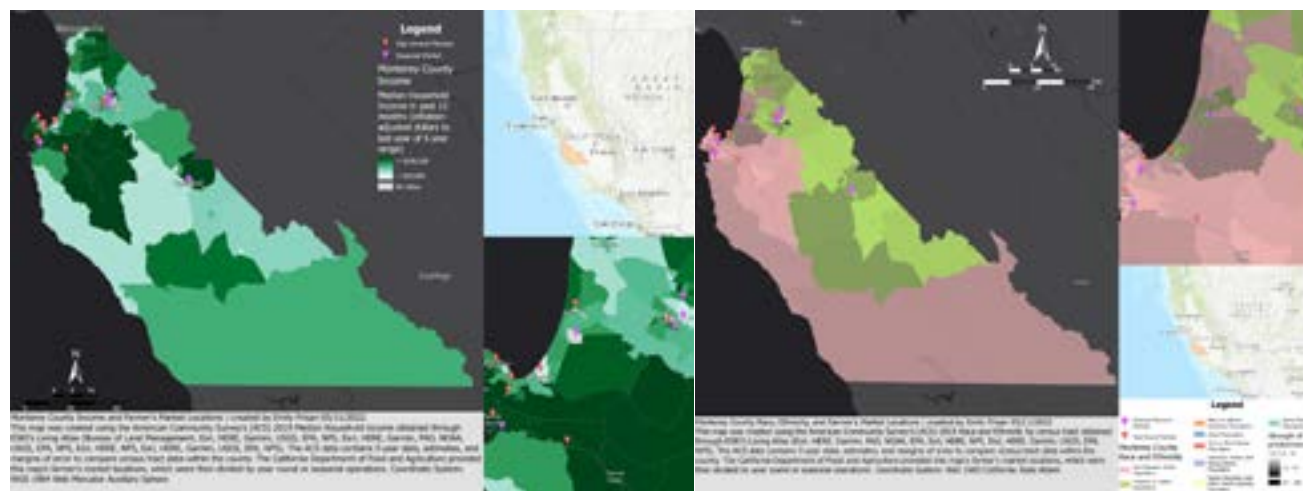
Limitations of Study

This study only studied six out of the 58 in California. The geography of the state provides immense agricultural and cultural diversity to observe. Although this study included every market in the counties during the study period, farmer's markets often run on flexible hours, often using alternative methods such as Instagram, Facebook, or Yelp to promote their hours and locations. Among the variability of locations, products and vendors at farmer's markets may be from out of the county or state, leading revenue to not directly benefit the community. This research also does not take into account farms that sell directly to consumers or roadside stands. Counties with more farms may contain a higher number of temporary produce stands that operate off-road or provisional locations that may be accessible for residents.

Discussion

Farmer's Market locations tend to settle in densely populated cities where race and ethnicity census tract locations were very bimodal, serving mostly predominantly White or Hispanic communities. The CDFA FM locations were important to control the locations of the markets. Literature has shown that shoppers in FMs are influenced by regional attraction and cultural acceptance.

In Ventura, Napa, Monterey, and Los Angeles counties, the markets spatially skirt around lower- income, minority communities and although residents can shop in locations of higher-income locations, it may create a social barrier for diverse communities to intertwine. Although the average median household income in California is $78,672, in counties like these, the cost of living is generally higher due to higher numbers of population or regional trends. Even in counties such as Fresno and Kern, the location of FMs settle in areas with denser populations, which therefore are able to serve more residents whether or not they're EBT recipients.

Combinations of demographic (race, and ethnicity) and socioeconomic data (median household income) samples while controlling the locations of the farmer's markets established a model to assess which areas are vulnerable to local food shops. Many markets are also located where many communities begin to intertwine, which explains why a majority of locations are in urban cities. This is where different levels of income and diversity in race and ethnicities begin to increase. Residents of lower-income communities, specifically in densely populated locations have access, but often must travel or accommodate for their needs to be met. Highlights the complex relationships of counties with drastic ranges of sociodemographic characteristics. As cities continue to increasingly urbanize, there should be an awareness of the unique role transformations of food distributions and systems create for food- insecure residents. Supplemental data provided by the USDA was important to document the significance of SNAP recipients in the counties to compare which areas are more in need.

Higher support for SNAP which can maintain or contribute to increased participation may lead to improved health conditions among low-income residents (Wang et al, 2021). We can assume that where EBT is used most frequently can be located based on the

median household income maps. Despite Los Angeles county having one of the highest EBT participation percentages, a majority of the fresh food outlets are located in high income neighborhoods. Fresno County enrolls the highest number of beneficiaries, outputs the most agricultural products, yet also has one of the fewest locations of FMs.

The inequality of locations is prevalent for residents due to urban areas, such as New York City or Los Angeles, buying and receiving fresher, more nutritious products at FMs (Kelley et al 2022). FMs vary by county needs and accessibility, however improvement for all can stem from both changes in policy and reforms that strengthen service-delivery systems.

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Gaytan
Luis   **Reasoning Globally: With a Little Help from Their Friends**

Abstract

The judicial globalization literature, and attempts to study it in the United States, has focused on the role of the judge as a deliberate, independent actor in the international environment. Research on Supreme Court opinion content, however, suggests that the opinion language is often influenced by actors outside of the judiciary itself. In this study, we assess the effect of transnational citations by parties' and amici brief on the Supreme Court's engagement in global judicial dialogue. The objective, on a cumulative level, is to assess and analyze the influence that amici briefs and lawyers have on judicial behavior withing the U.S. Supreme Court when it comes to judicial globalization. We use an original database of foreign and international law citations in briefs and opinions, and overall, we show that, litigants and friends of the court are significant actors in this process of judicial globalization.

Introduction

In the 2005 case of Roper v. Simmons, the United States Supreme Court found that sentencing juveniles to death is a violation of the Eighth Amendment. The majority opinion, authored by Justice Kennedy, stated, among other things, that "Article 37 of the United Nations Convention on the Rights of the Child, which every country of the world has ratified save for the United States and Somalia, contains an express prohibition on capital punishment for crimes committed by juveniles under 18" (Roper v. Simmons 2005, 22). With the use of this citation, in addition to offering his opinion on the other branches' behavior on international matters, Justice Kennedy appeared to reaffirm a seemingly increasing trend in Supreme Court opinion writing: the citing of foreign or international law materials in domestic cases. Before Roper v. Simmons, the U.S. Supreme Court had brought this practice to the forefront by utilizing foreign or international law in several high-profile cases, including Lawrence v. Texas (2003) and Grutter v. Bollinger (2003). While the engagement of the United States Supreme Court in this transnational dialogue in Roper v. Simmons did not remain unnoticed by the Court's audience, less attention was paid to the number and diversity of briefs filed at the merits stage of the case, citing various sources of foreign and international law. Simmons' lawyers cited four international treaties and a decision by the Inter-American Court of Human Rights in their merits brief. Additionally, five amici, ranging from the ACLU to the European Union, including 37 citations to decisions of foreign national courts, and international courts and treaties.

Despite above indications that lawyers and interest groups do play a role in cases when courts engage in transnational communication, the judicial globalization literature, at least in the United States, has mostly focused on the role that Justices of the U.S. Supreme Court play in global judicial dialogue. Research on the influence of briefs on judicial behavior, however, suggests that by ignoring actors such as lawyers and amici, we might be missing an important aspect of judicial globalization. In fact, during the past decades, courts have been inundated and flooded with amicus briefs – documents that oftentimes third parties file in order to add substance to the matter at hand and to be part of the litigation in the small form.

In this study, we bridge the judicial globalization and American judicial behavior literatures, so as to assess whether global judicial dialogue is a process solely driven from above, or if lawyers and interest groups are also essential participants. We argue that amici and parties' briefs provide the Justices of the Supreme Court with important information regarding developments in foreign and international law and their relevance to the cases under consideration. This, in turn, gives Justices who are amenable to transnational communication the opportunity to include such citations in their written opinions.

To test this argument, we constructed an original dataset of foreign and international law citations found in parties' and amici briefs, as well as of transnational citations in Supreme Court opinions, from 1989 to 2015. The analysis of the data indicates that Supreme Court Justices are more likely to engage in transnational communication when provided with relevant arguments in the briefs of a case. The findings of this study illustrate the importance of actors other than the judiciary in the promotion of a global judicial structure, and provide support to previous findings regarding the effect of briefs in the process of judicial decision-making.

Judicial Globalization from Below

The steady increase of the national courts' reliance on foreign and international law citations in their opinions, labeled "transnational communication", has established domestic judges as significant, independent actors in the international environment (Slaughter 1994). As part of the process of judicial globalization, judges travel abroad, participate in international conferences, meet with their colleagues, and through this direct communication, they gather information about legal developments across borders (Slaughter 2004).

Apart from this direct learning process, advancements in technology are also suggested to be facilitating transnational communication among judges. Court opinions from all over the world are now translated in English and published online, making it easier for judges to consult foreign sources in the process of deciding a case (Slaughter 2004). These developments, according to the judicial globalization literature, have made domestic judges significant actors in the establishment and enforcement of international law domestically, especially when it comes to the effective enforcement of international human rights (Diel, Ku, and Zamora 2003, 50; Waters 2007, 633).

Considering the literature's focus on the judge as an individual with cosmopolitan preferences (Breyer 2015), it is probably unsurprising that the few studies that move beyond a normative discussion of the phenomenon in the United States choose to pay attention to the ways judges utilize transnational sources. Current judicial globalization literature aims to analyze patterns of behavior relating to international courts and domestic resistance toward international court rulings (Madsen et al. 2018). Even in this aspect of how domestic judges in the U.S. use transnational sources, research has reached contradictory conclusions, since on one hand, Supreme Court Justices appear to engage in this behavior strategically, so as to increase the persuasiveness of their decision (Black et al. 2014), and, on the other,

federal judges are suggested to make a very limited use of transjudicial communication, mostly in cases that already involve foreign law (O'Brian 2006; Zaring 2006).

We argue that, to be able to acquire a more complete understanding of judicial globalization, we should move our focus beyond the judges as the sole actors in this dialogue and examine other actors that potentially affect the proliferation of transnational communication. As research on the revolution of rights has shown, willing judges are not the only necessary condition for the development of domestic law; strategic advocacy pressuring the judiciary from below is also required (Epp 1998).

This emphasis on pressures from below is also present in the international environment, where international organizations and transnational activist networks attempt to pressure states to adopt and enforce international norms domestically. In this way, international organizations function as teachers of international norms (Finnemore 1993; 1996), and transnational and activist networks push for their internalization (Keck and Sikkink 1998; Risse-Kappen, Ropp, and Sikkink 1999). This "transnational civil society", in many ways similar to the existing one in the United States in the era following Brown v. Board of Education, is suggested to have helped judges around the world acquire the status of independent actors in the international system (Kersch 2004).

One way for these groups to internalize foreign and international law through the domestic judiciary is by filing amici briefs that cite foreign and international law, since such briefs give groups the opportunity to communicate to judges what they think the interpretation of a law should be (Collins, Corley, and Hamner 2015). Judges, on the other hand, trying to gather as much knowledge as possible regarding the case under deliberation, find amici briefs useful due to the information provided through them (Collins 2008; Epstein 1993). To that end, there is evidence in the literature of courts deferring to amicus briefs filed by foreign courts, following a standard of deference established for judgements of the International Court of Justice (Farenthold 2019).

Moreover, amicus briefs appear to influence the justices across the ideological spectrum. The influence is somewhat greater among the more moderate justices, although the relationship between amicus influence and judicial moderation is a weak one. The Supreme Court justices appear to respond positively to the persuasive attempts of amici. This impact is most noticeable for the justices in the middle of the Court – those who tend to be most influential in steering the Court's decision making (Pacelle et al 2018; Wiik 2018), illustrating that briefs can be effective even in an ideologically polarized court. While that could be an effect of amici pursuing courts that align with their ideological beliefs at the state court level (Kane 2017), friends of the court do not get such an opportunity to forum shop when a case reaches the U.S. Supreme Court.

When it comes to their informational advantage, amici briefs can include reliable information regarding the wider consequences of a case outcome (Caldeira and Wright 1988; Collins 2004), as well as arguments and authorities missing from the parties' briefs (Kearney and Merrill 2000; McGuire 1993). Most studies of amicus influence in both federal and state courts assume that the information provided in these briefs is the machnism through which amici influence court outcomes (Kane 2017). These particular characteristics

of amici briefs make them an effective tool of influence of Supreme Court Justices, who often adopt the language and authorities included in the briefs (Collins, Corley, and Hamner 2015; Ennis 1984; Epstein and Kobylka 1992; Owens and Epstein 2005; but see Spriggs and Wahlbeck 1997).

Apart from the amici briefs filed in a case, judges acquire information from the briefs submitted by the parties. Parties' merits briefs familiarize judges with the facts of a case and inform them about the legal authorities pertinent to the issue at hand. Judges, in turn, when they construct their written opinion, give special attention to the language used in the merits briefs, since they appear to rely on them more, compared to language stemming from lower court opinions and amici briefs (Feldman 2017). In fact, certain Supreme Court Justices seem to use merits briefs as their main tool in the process of opinion writing, by lifting extensive parts of the opinion language directly from the parties' briefs (Feldman 2016). Based on this evidence, "the parties, through the briefs submitted on the merits, have the ability to influence the content of opinions, and consequently, have the ability to influence the law" (Corley 2008).

If the content of the opinion produced by the Supreme Court is shaped to such a great extent by the parties involved in the litigation, and by the friends of the court with an interest in the outcome of the case (Wahlbeck 1997), then, the instances of transnational communication occurring through Supreme Court opinions might not be solely a result of the Justices' active search for these authorities, but also of the inclusion of this type of language in the briefs. Specifically, we argue that, just as social science sources made their way into Supreme Court opinions through briefs (Epstein and Black 2007; Margolis 2000), the inclusion of foreign and international law authorities in parties' and amici briefs informs judges of legal developments beyond the domestic borders, along with their potential applications on a case. Consequently, we expect that the citation of transnational authorities in the briefs of a case will increase the likelihood of transnational communication on behalf of U.S. Supreme Court Justices.

H1: Foreign and international law citations are more likely to be used in Supreme Court opinions when such authorities are referenced in the parties' briefs on the merits, compared to cases where parties' briefs cite solely domestic law.

H2: Foreign and international law citations are more likely to be used in Supreme Court opinions when such authorities are referenced in the amici briefs on the merits, compared to cases where the amici briefs cite solely domestic law.

It should be noted at this point that, in this study, we do not theorize on the reasons behind a Justice's choice to engage in transnational communication. Justices who rely on foreign and international law citations in their written opinions might do so because they consider these authorities persuasive, or because they have adopted a cosmopolitan attitude, or simply because they need as many sources as possible to support the outcome they prefer. Regardless of the reasoning, the fact is that transnational citations do appear in court opinions; the focus of this study then is the route that these citations follow to become part of the Supreme Court language.

Descriptive Analysis of the Data

Throughout the course of our investigation, our team was tasked with retrieving salient information from amicus briefs, merit briefs, and cases that were tied with two conventions: one, the Geneva convention, and two, the Convention on the Rights of the Child. Such information included the name of the case, identifying whether it was a court opinion/lawyer brief/ or a merit brief, the month and the year, identifying the international treaty, the case number/citation if it's a case, identifying who filed it if it is an amicus brief, and the court hearing the case.

One of my assignments was tasked with the Geneva Convention, ranging from 2020 to 2011, and from 1999 to 1990. Moreover, the gathering on the data took place remotely, with each of us assigned to different years and conventions. Subsequently, the database that was used to retrieve such information was WestLaw. Upon entering into WestaLaw, we proceeded with inputting our conventions name in quotations, and enabling federal and state results. Upon the results showing up, we then proceeded with gathering all of the information that was listed above, and began inputting it into an excel sheet, which allowed us to visually observe the patterns that were at glance. After inputting all of the court opinions, merit briefs, and amicus briefs, we were then tasked with separating them according to the year and the court. This, in turn, allowed us to assess whether there is an increase in citations throughout the years, and if any increase is as a result of more citations my judges in court opinions, by lawyers in merit briefs, or by organizations in amicus briefs. On the other end, this will now allow us to look at whether it is specific courts, or specific organizations that play a bigger role in the diffusion of the treaty we are analyzing in the United States.

Beginning with court cases that were cited between 1990 and1999, there does seem to be a slim increase we increment years. However, between the years 1993 and 1995, there appears to be a drop in cases. As we are able to see within these graphs, there seems to be an influx of court opinion citations in the beginning of the decade, with a steady decrease and slight increase following until 1992. Nevertheless, is it not until 1993 where we begin to notice a deficit, with a record low of only 3 court opinions for that year. Three years later, we are then able to appreciate a pattern which is not linear, as it increases, drops, and then increases. Is it not until 1997, at this point, we are now able to see a linear pattern of slow but steady increase in court opinions. Thus, as the table shows, we are now able to see that the trajectory of court opinion cases, as the year increases, seems to resemble an unpredictable behavior that that does not seem to follow any linear patterns, if not until the last three years.

Year	Court Opinion Citations	Year	Court Opinion Citations
1990	10	1995	4
1991	5	1996	10
1992	7	1997	7
1993	3	1998	8
1994	7	1999	10

On the other end, upon glancing at the data that was retrieved from 1990 to 1999, it is evident that amicus brief citations are scarce and incipient, and no pattern related to the increase of the year and amicus briefs is noticeable. However, taking a look at the merit brief citations, it seems to indicate that there is no linear pattern between the increment of the years, and the number of merit briefs cited. However, based on the number of merit brief citations, and the number of courts opinions cited in the years 1992, 1996, and 1999, which happen to years in which there is a spike, there seems to be miniscule correlation, but nothing extraordinary throughout the years. In the end, the data that is presented here seems to demonstrate small relationships throughout the year, but to infer that there are linear patterns as the years go by, would not be adequate.

Year	Merit Brief Citations	Amicus Brief Citations
1990	0	0
1991	2	0
1992	3	0
1993	0	0
1994	1	0
1995	0	0
1996	3	2
1997	1	0
1998	1	0
1999	4	1

Additionally, fast forward 12 years, we are now beginning with the years 2011 to 2020. At first glance, we are able to observe that there are no long-term linear patterns. However, if we take a closer look in small subsequent years, we are then able to notice a decrease in court opinion citations, beginning from 2012 to 2014. Once the year 2014 begins, we are than able to see a steady plateau until the year 2018. Moreover, the last two years do not seem to remember any kind linear pattern, other than an increase after 2018, and a decrease after 2019. In the end, as stated previously, not long-term patterns related to the increase in years with court opinion citations are demonstrated within this chart.

Year	Court Opinion Citations	Year	Court Opinion Citations
2011	32	2016	22
2012	22	2017	23
2013	31	2018	22
2014	28	2019	26
2015	28	2020	19

Subsequently, taking a look at data regarding merit brief citations and amicus citations from the year 2011 to 2020, we are able to observe that there that there is no correlation between the two of them. Neither of them seems to demonstrate a simultaneous increase or decrease as the years increase. However, taking a look at the merit brief citations individually illustrates smaller patterns. For one, between the years 2012 and 2016, there seems to be a small plateau of citations. Which demonstrates that there was neither an increase nor decrease through these years. Additionally, the last 4 years seem to show a spike of cases that remains about the same, but high deficit of citations in the last year. On top of that, while analyzing both charts and identifying any notable overlying patterns, there does not seem to be any outstanding linear patterns that indicate and increase or decrease based on merit brief citations, amicus brief citations, or court cases.

Year	Merit Brief Citations	Amicus Brief Citations
2011	15	12
2012	5	13
2013	3	4
2014	5	6
2015	6	0
2016	3	2
2017	10	13
2018	10	3
2019	11	3
2020	2	1

Lastly, taking a look at amicus curiae briefs, and where they are being filed, and which parties are filling them, there seems to be one common denominator among them, that being the United States Supreme Court. Which, in turn, indicates that all of the amicus curies are being filled from top to bottom. On the other side, in terms of repeat parties that are refiling amicus curiae's, the most amounts of time one party will file, seems to be four, while the common denominator among Year other parties who are filing seems to be two.

Year	Court	Amicus Brief Citations
1990	Supreme Court of the United States	0
1991	Supreme Court of the United States	0
1992	Supreme Court of the United States	0
1993	Supreme Court of the United States	0

Year	Court	Amicus Brief Citations
1994	Supreme Court of the United States	0
1995	Supreme Court of the United States	0
1996	Supreme Court of the United States	2
1997	Supreme Court of the United States	0
1998	Supreme Court of the United States	0
1999	Supreme Court of the United States	1

Year	Court	Amicus Brief Citations
2011	Supreme Court of the United States	12
2012	Supreme Court of the United States	13
2013	Supreme Court of the United States	4
2014	Supreme Court of the United States	6
2015	Supreme Court of the United States	0
2016	Supreme Court of the United States	2
2017	Supreme Court of the United States	13
2018	Supreme Court of the United States	3
2019	Supreme Court of the United States	3
2020	Supreme Court of the United States	1

In the end, we were able to see that there are miniscule patterns that relate court cases, amicus curiae's, merit briefs, to the amount and year in which they are filled. Although there were some plateaus and miniscule amounts of correlation, further research that is able to expand on more conventions, might be able to draw more data and results, thus allowing them to observe greater patters that were not found here.

Analysis of actors promoting international law citations

For this part of our analysis, we focused on the Convention on the Rights of the Child and its diffusion through the judicial system of the United States. The Convention on the Rights of the Child has helped advocate for children's rights. World leaders came together and formed a joint consensus that the world's children must be protected and every child is recognized with fundamental human rights that ensure their well-being and basic quality of life. Unfortunately, some children experience shortcomings of their basic human rights and this is when the Convention on the Rights of the Child is executed for use. This international treaty is taken with the utmost seriousness and failing to commit to it is handled within the United States justice system. As children have the right to protection of the law against mistreatment, abuse, attacks or neglect, the U.S. justice system ensures civil, political, economic, social, health, and cultural rights of children. Throughout the years, citations of the convention on the rights of the children have been found in merit brief citations, court opinions, and amicus briefs.

The earliest court opinion of the convention was cited in June of 1992 in the Superior Court of Connecticut, Judicial District of Litchfield in the Batista v. Batista case and the most recent occurred this year (2021) in Luther v. Hunt in the U.S. District Court, D. Connecticut. To date, there have been 6 merit brief citations and 51 amicus briefs in regards to the convention from 2012-2021. In addition, 57 merit briefs and amicus briefs, in regards to the convention, were referenced from 2012-2021. Further, courts throughout the United States have cited the treaty 126 times in court opinions from 1992-2021.

There are 94 federal judicial districts organized into 12 regional circuits which help form the United States Courts of Appeals. The Court of Appeals, specifically, have referenced the convention of the rights of the child 42 times in court opinions from 1992-2021. The state with the most references of the convention on the rights of the child is California with 14 court opinions, followed by New York state with 9 court opinions and the District of Columbia (D.C.) with 9 court opinions. The years with the most court opinions referencing this treaty are 2007 (10 court opinions), 2010 (11 court opinions), 2011 (12 court opinions), and 2019 (10 court opinions). On the other hand, 2013 and 2015 were the years with the combination of the most merit brief and amicus brief references with 2013 taking the lead with 14 citations followed by 2015 with 9 citations.

Matching of Court Opinion, Case Briefs and Amicus Curiae Briefs per Court Case

In assessing the effects of transnational citations by litigants, parties, and friends of the court on judicial globalization, the original database of both foreign and international law citations, is heavily used. Moreover, there is a significant focus on coding the specific briefs of the Geneva Convention briefs and opinions of which these outside actors have participated. There is a focus on the Geneva Convention, in addition to the Rights of the Child. Foremost, to begin gathering data on the significant impact of these outside actors, the use of the database Westlaw is heavily relied on. Once navigated to Westlaw, it is imperative to toggle the funnel in which cases will be sorted. I was able to toggle the filter on Westlaw to funnel results on both the state and federal levels. Moreover, after toggling the filter, I then searched "the Geneva Convention" within the Westlaw database – being sure to make us of quotation marks. The reason for using quotation marks during the search is to narrow the search even more. The further sorting of the cases helps find the cases that have utilized the language of the Geneva Convention in their decision in a given case that has populated due to the initial search.

Navigating to the upper right-hand corner and submitting to the search, thousands of results are populated – even with the funnel and parenthesis used. Turning my attention to the left-hand side of the screen there are columns that give results on cases, briefs, and even regulations that mention the Geneva convention directly. The first data gathered through the syphoned search is a focus on the cases. The first step in gathering the information on cases is to sort even further, zeroing in on cases that were decided from the years 2000 to 2010. To further sort by year, there is an option in the top right-hand corner that offers more filters for the massive number of results that have populated. When case coding it was important to collect data on the name of the case the court it was heard in, the date, the year, the case number or citation, the type of case, and the international treaty it is linked to – in this the Geneva Convention.

While collecting the data, excel is also greatly relied on to organize the characteristics of the cases that are to be coded. In the first column, on the excel sheet that will house the coded cases, it is appropriate to add the cases' name, which can be found next to the Westlaw numbering of results. Next, the court in which the case was heard is listed in the next column by its name – the court is mentioned first under the case name. In addition to the case name and the court that heard the specific case, the date and the year are added to the next column in the excel sheet; the date will show when the court made a decision on the case. It is possible to find the date and year of the case mentioned next to the court that decided the case. In this particular data set, coding the date and year includes the month, the date, and the year. Moreover, the case number and/or the citation is added to the excel sheet in the column adjacent to the last column that was added. To find the case number and/or citation it is noted in the first number after the date that is listed on the result of a case that has populated.

The second to last step in establishing how the cases will be coded, and their context, includes the type of case it is. The types of cases that are coded in this specific data set include court opinions, merit briefs, and amicus briefs. While coding these given case results it is imperative to code these types as court opinions every time. Lastly, while coding these cases it is also important to note on the excel sheet what International Treaty these cases adhere to. In the case of this specific data set, the treaty that was being coded for at the time was the Geneva Convention – this column is the very last one next to the type of case column. Throughout the data set, there is a significance difference in the names of the briefs noted – merit briefs and amicus briefs. Each with their own distinct way to be coded, they will still find themselves on the same excel sheet in the context of coding

for the Geneva Convention and the cases it is involved in.

 In addition to the cases that have been coded, there is also a supreme focus on the briefs that mention our international treaty – the Geneva Convention. An important fact to note is the fact that all cases will have a merit brief but not all cases will have an amicus brief adhered to it. Westlaw will show merit briefs under different names such as: "petition for Writ of Certiorari", "brief in opposition", brief for petitioner, reply brief, and brief for respondent. All of which have been coded under the "type" merit brief on the excel sheet. Moreover, there is also a concentration on the petitioner and respondents that have also filed these merit briefs – also known as the filer. The Petitioners also have different names that help identify them, such as "petition for a Writ of Certiorari", "brief for Petitioner", and "reply brief". On the other hand, Respondents also have identifiers such as: "brief in opposition" & "brief for Respondent".

When coding the merit briefs it is important to note the case name, the court, the date, the year, and the international treaty that is being coded at the time. The briefs, just like the cases, earn their own excel sheet due to the multitude of number populated by the initial search. First, the name of the case must be plugged into the first column of the excel sheet. To find the case name on Westlaw, it will be the first entry under the type of brief. Next, the court that has heard the case – which can be found next to the entry after the court name. In contrast to the cases that have been coded, the filers adhere to the brief – either petitioner or respondent. Furthermore, on the excel sheet the date and the year of a given brief is also coded in the column over from the case name and the court that heard the case. It is possible to find the date and year of the brief next to the entry after the court name. Lastly, in the context of coding the merit brief for petitioners and respondents, the international treaty that is being coded at the time, the Geneva Convention, is also added to its own column – which is the last column adjacent to the second- to-last column of the date and the year.

Amicus briefs, or documents that have been filed by parties not directly involved in the litigations but show an interest in the case, are also coded on the same excel sheet as the merit briefs. To identify an amicus brief, the mention of "amicus curiae" in the title of the brief is the signal to code that specific brief as the type called amicus brief. Coding amicus briefs also includes the case name, the court in which it was heard, the date, the year, and the international treaty in which it observes. In addition to these characteristics being coded, amicus briefs require that the group in which the case has been brought needs to be coded as well. In this instance, the first group that is mentioned in the amicus brief is to be coded – the very last column. In the case that there is more than one group that has filed the brief, it is only necessary to include the first name of the individual or organization cited – which has been done with the data that has been collect and coded.

With the data set that has been constructed due to the coding methods of merit briefs including court opinions, merit briefs, and party briefs the next step is to construct the data analysis of the coded cases. The data analysis that was conducted on the results of the coding was the matching of the court opinions, the merit briefs, and the amicus briefs for each case. In this method, the only thing that is imperative to be added in the cases that produced a citation in more than one document. The data analysis of the coded data is

significant in uncovering the impact of this convention, the Geneva Convention, and how its carried through the United States legal system. Moreover, the data analysis will show how these outside actors influence have influences the system – either bottom to top or top to bottom.

The first step in the data analysis is to sort the data set by case name. In order to tackle the multitude of cases that have been coded it makes sense to organize the cases in alphabetical order – in ascending order. Selecting the first row that houses the list of case names, it is imperative to select this entire column in order to produce the correct sort. Selecting the number that sits atop the entire column will allow for the whole column to be selected. To execute the sort, there is an option that excel offers that helps perform the task. In the upper right-hand corner, there is an option to edit the spreadsheet. Selecting this option will produce another mini menu that depicts a funnel with the letter's "A" and "Z" next to it. Selecting this option will execute the sort for the first column only. However, all rows attached to all columns must be sorted as well. Once the option is selected, another option to sort columns outside of the selected column will be presented. Selecting this option will execute the entire sort, in addition to the rows that adhere to the case names in the first columns that houses the case names. The same sorting method is used on all cases and briefs that have been collected.

Moreover, the second step in working through the data set – is to work through it. The best way to collect this data, is to split screens on a computer if possible, and match cases that have a citation in multiple places. The main reason to use this method in matching is to identify whether the citation has been found regarding the Geneva Convention treaty in either: a court opinion, merit brief, and/or amicus brief. The chart below shows examples of how to identify whether a given case included multiple citations:

How to identify multiple citations:
  1. Case A: Citation in court opinion and merit brief.
  2. Case B: Citation in court opinion and amicus brief.
  3. Case C: Citation in merit brief and amicus brief.

Furthermore, once identified, it is important to make a list of all the cases that may include a citation in more than one document: court opinions, merit briefs, and/or amicus briefs. This can be done by hand or, typing each individual instance when multiple citations are noted in a word document for future reference. The list will also produce numbers on how many times the convention was picked up. Again, there is only a need to include, in the list, cases that have a citation more than one document. Ultimately, this specific part of data analysis is used to assess whether citations in merit briefs and amicus brief have been picked up by judges and used as a tool in their court opinions.

The method used to address the original question of conducting content analysis is dependent on three specific actors: court opinions, party briefs, and amicus briefs. These actors are to have cited one of the two conventions of interest – the Convention of the Rights of the Child & the Geneva Convention. Of the 836 combined number of cases and briefs, the grand total of times the citation of the Geneva Convention was mentioned hit a grand total of 42. Of the 42 citations, 39 included amicus briefs in addition to 39 merit

briefs that were picked up in all cases that were coded. In the context of our own research, our expectations were that engaging in judicial dialogue was to show a process directed, not only by judges through citations in their court opinions, but also by lawyers and amici briefs through specific citations that are found in their briefs. Through the data collected, it is illustrated that the Geneva Convention is not catching the interests of many judges in a manner it is being picked up and utilizes by judges themselves.

Conclusion

The end goal was to map the citations to each convention from their point of entry into the United States legal system to where the citation is most currently situated. In the context of the Geneva Convention, it is clear that judges are picking up this Convention – it seems to be getting most of its attention from lawyers. Our initial question sough to address is judicial globalization in the United States a process initiated by judges or a process that is initiated from below. To respond, there was mapping of international law citations as they moved through the U.S. legal system. The two Conventions used, the Convention on the Rights of the Child & the Geneva Convention, were used so as to be able to assess whether the diffusion of these in the legal system differs based on the ratification status given by the United States. Ultimately, we have proved that the focus of the literature is not, and should not, be only on judges but also on other actors found inside the legal system. In the data gathered in this subset of a time frame regarding the Geneva Convention, it is clear that the process is beginning from below and exercising its influence to the top level – being initiated from outside actors that are found inside the legal system.

Subsequent research will focus on expanding the current dataset of citations of the Geneva Conventions and the Convention on the Rights of the Child so as to provide us with the potential to construct a network map of all citations from the introduction of each treaty into the judicial system of the United States to the current day.

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Glaude Analexis*

Dr. M. Brigitt Laothe-François

Parental Involvement and its Influence on Women of Color Attaining PhDs

Abstract

Research has shown that parental involvement can have an impact on a child's academic success. This study examines the correlations between past parental involvement in education and future success. Success can be defined in many ways, especially when culturally relevant factors are taken into consideration. Benson et al. (2020) found that career success can be defined broadly into four different quadrants, Performance and Advancement, Self-Development and Creativity, Satisfaction and Security, and Cooperation and Contribution. For the purpose of this study, we are defining success as obtaining a PhD. This study focuses specifically on women of color and how past parental educational support may have influenced their obtainmnet of a PhD. We foud that there are three major themes of parental support in education: parental involvement, parental expectations, and motivation. We also found that parental influence does yield a possible correlation to future success in our study.

Introduction

Women often face a "glass ceiling" in the workplace preventing them from being promoted to positions of leadership in their careers (Hoyt, 2010). The women that are able to overcome these obstacles and make it leadership roles in their careers, possess valuable information that can potentially help other women of color climb the ladder of success. In addition, Hoyt & Murphy (2016) emphasized that women who have succeeded in the workplace can act as inspirations and help other women see a real example that success as a woman is possible.

The current study aims to highlight the successes of women of color and to celebrate their achievement of earning a PhD. In addition, this study aims to provide parents of color insight into how they might positively influence the academic development and success of their children. By sharing the stories of participants, this study aims to act as an inspiration for other women of color and provide a story that they can relate to.

Literature Review

Parental Expectations

In terms of literature on parental expectations and education, a study from Hascoet, Giaconi, & Jamain (2020) found that parents of high socioeconomic status (SES) with children who excel at math have higher expectations of their children's math scores. This study's findings shows a correlation that parents who expect their child to do well in their math classes have children who are more likely to succeed in these classes.

In addition to this, a study from Song & Petracchi (2020) found that of their population sample, only 7% of students said they had not talked about college with their parents. This study also found that 54% of parents in this study never attended college, yet 75% of parents expected their child to attend a 4-year college/university. This finding fall in alignment with the theme of parents wanting more for their children than they had for themselves. Conversely, parents may want their children to attend college and obtain more success than they were able to achieve.

Parental Involvement

Hill et al. (2018), discovered that parents of color have different goals and attitudes towards their student's academics. Findings from this study demonstrated that children of culturally different parents had different ideas towards school, depending on their ethnic group. A study from Wong et al. (2018) found that parental involvement in education can be beneficial, but only up to a point. If a parent becomes to involved in their child's education, this can cause a lack of independence for the child and a lack of motivation to learn. Therefore, there seems to be a balance between parental involvement and level of independence and motivation of children.

Motivation

Extrinsic and intrinsic motivation also play a role in success in school, meaning that some students are motivated to do well in school on their own without encouragement from parents, while other students rely on parental encouragement. A seminal work performed by Hayenga and Corpus (2010) evaluated extrinsic and intrinsic motivation in middle school aged children. They divided motivation into four different groups: high extrinsic and intrinsic motivation labeled as "high quantity", low extrinsic and intrinsic motivation labeled as "low quantity. Whereas, low extrinsic motivation and high intrinsic motivation labeled as "good quality", and high extrinsic motivation and low intrinsic motivation labeled as "poor quality". This study found that higher intrinsic motivation and academic achievement were positively correlated, while higher extrinsic motivation and academic achievement were negatively correlated. More specifically, the students who had motivation in the "good quality" group had better grades than the other children in the study who fell in different categories. Therefore, this study claims that the mere existence of intrinsic motivation does not guarantee academic success, but it is the amount of intrinsic motivation compared to the amount of extrinsic motivation.

A study from Garn and Jolly (2014) also addressed motivation, in terms of academic success in students with a mean age of 9 years old and labeled as academically "gifted". This study found that educational engagement for these children meant making learning fun and having the opportunity to make decisions about what they learn in class. A high majority of students in this sample had parents who offered extrinsic rewards for good grades, which motivated them to achieve, but some also stated that they were already motivated to achieve without these extrinsic rewards. Garn and Jolly (2014) posit that using external rewards can result in a decrease of intrinsic motivation that might have already been present in the child. This study also found that children in this study feel a sense of pressure to earn good grades because of the need to make their families proud.

Another study that observed the role of intrinsic and extrinsic motivation in gifted children found that 9th-11th graders in Jordan displayed high levels of intrinsic and extrinsic motivation (Al-Dahmit & Kreishan, 2016). The researchers also found that females were more likely than males to appear unmotivated in academics, however they emphasized that this is because of the culture in Jordan and how women are expected to behave. This highlights cultural differences for women of color in terms of societal and cultural expectations.

Motivation was also assessed in sixth graders in terms of parental involvement in homework and motivation style of the sixth graders (intrinsic or extrinsic) according to a study by Knollman & Wild (2007). This study found that parents who offered their support to their children in terms of autonomy had different reactions depending on their motivation style. Children who were more intrinsically motivated had more positive reactions to the autonomous style than the children who were extrinsically motivated. In the second part of this study, students who were intrinsically motivated to do their homework had emotions that positively correlated with joy and pride (Knollman & Wild, 2007).

The literature thus far has yet to explore how parental involvement during childhood can affect future success in terms of obtaining a doctoral degree. Most literature regarding parental involvement and success revolves around current parental involvement and how it affects success in the classroom for adolescent aged children. One of the oldest age groups that parental involvement in education consisted of high school students(Catsambis, 2001). Catsambis also found that parental involvement can influence children and make them more likely to take certain high school courses and earn credit specifically in math, english, and science.

Hypotheses

The hypotheses for this study are as follows: a) Parental educational support will have a positive correlation with future success. b) Women of color became successful because of past positive parental support. c) There will be a common theme of support amongst women of color in terms of the amount of support their parents provide. However, the ways in which different cultures display support may be different.

Methods

Participants

This study used purposeful sampling to recruit participants. Purposeful sampling was used due to the specificity that this study required. Participants were required to be women of color, faculty at a University in the United States, and have obtained a PhD. There are a total of 4 participants in this study.

Materials and Measures

This study collected data through a questionnaire where participants' responses from the Qualtrics survey as the form of data collection and analysis. The questionnaire assessed

the involvement level of parents of women of color. This questionnaire consists of 23 open-ended questions. From this questionnaire, the responses of all 4 participants will be compared and contrasted to each other to identify possible patterns or unique responses to the interview questions. The questionnaire was loosely based off of parental involvement types created by Epstein (1992). Catsambis (2001, pp. 150) summarizes these types as " (1) parent practices that establish a positive learning environment at home, (2) parent-school communications about school programs and student progress, (3) parent participation and volunteering at school, (4) parent and school communications regarding learning activities at home, (5) parent involvement in school decision making and governance, and (6) parent access to community resources that increase students' learning opportunities".

Procedures

Women of color who agreed to participate in this study were sent a Qualtrics link to fill out an informed consent document. After filling out this informed consent, participants were emailed a separate link to the questionnaire. The entirety of the study was completed online. Participants were not compensated for completing the study.

Findings

Three main themes emerged from the questionnaire data: Parental involvement, parental expectations, and motivation (intrinsic and extrinsic). These themes were then broken down into sub-themes to further analyze participant responses. The following themes loosely coincide with the themes established by Gordon & Cui (2015) on positive parenting, although their themes were not directly used in the current study.

Parental Involvement

The theme of parental involvement was broken down into three sub-themes: academic involvement, academic support, and academic assistance.

Academic Involvement

All participants stated that their parents attended "back-to-school nights" and parent teacher conferences. From this, all parents in the study demonstrated high levels of involvement in this regard.

Academic Assistance

Half of participants stated that their parents set a distinct homework schedule for when they should complete homework (Participants B and D), with one participant stating that they did not have a set homework schedule put in place (Participant C). Alternatively, Participant A had a different circumstance where there was no distinct homework schedule, yet homework expectations were still in place. She related, "While they did not set a routine, I was expected to complete homework and study when I returned from school. I believe I followed the routine of my older brother."

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Half of participants also reported that their parents helped them with homework or school projects (Participants A and D). Participant B related she was unable to ask for homework help because there was a language barrier as her parents were not fluent in English. Participant C reported no homework help.

Academic Support

Participants A and D reported that their parents were very involved in their educational lives. Participant A differentiated between the involvement from her parents, "My mother was involved in my performance as a student and athlete." while also stating that, "My father provided more of emotional support." Participant B noted that her parents were involved but since she succeeded in school, there was not much for them to do. Participant C noted that her parents showed their involvement by being role models but in a more indirect way, "They modeled this ethic but did not make it the center of our conversations."

Participants A, B, and D attribute some of their journey to earn a PhD to their parents involvement. However, Participants B and C noted facing some concern from their parents in their pursuit of a PhD. For instance, Participant B stated her parents were worried about her not being able to make enough money because they, "did not understand why on earth I would study archaeology and art history." Participant C faced different parental concerns, relating, "they asked me when I was ever going to get married."

When recalling specific memories of support from their parents, Participants A and C emphasized that their parents always came off as supportive in their academic endeavors through actions such as paying tuition fees and bragging about their child's accomplishments. Participant D recalled that her dad made her and her sister, " memorize the beginning of the dictionary and quizzed us on the encyclopedia." However, Participant B recalls her parents lack of involvement in grad school, but stated they, "came around eventually." Participant D stated that her parents were involved in her college application process, her father "attended college tours and information sessions with [her]". Participants A and B reported completing college applications without the help of parents. Participant B noted she filled out applications on her own because she was the oldest and had to figure it out on her own. Participant C stated that her parents' only request in terms of the college process was that she apply to a college nearby.

Parental Expectations

The theme of expectations was broken down into three sub-themes: Grade expectations, college expectations, and future success.

Grade Expectations

Expectations of grades in our study varied significantly amongst the participants. Participants A, B, and D stated that their parents expected them to achieve good grades while Participant C did not have this expectation. Additionally, Participants A, C, and D all reported that they have received a poor grade in the past. However, these poor grades were all treated differently. Participant A's father, "implemented a weekly progress report from

my teachers in the classes I was struggling in." Participant C reported that her parents simply signed her report card and Particpant D received encouragment from her parents to get help from teachers. In terms of school work expectations, Participant A and D noted that their parents expected them to do their homework neatly, "If I had too many eraser marks on a page, she would make me do the whole assignment over on a new page." (Participant A). Participant B's parents expected her to do well in school and Participant C's parents just wanted her to do her best.

College Expectations

Participants A, B, and D were expected to attend college while college attendance was a
choice for Participant C. Participant D related that college was an expectation "from the very beginning of [her] life." Although Participant A was given a choice to work instead of college attendance, she stated that this was never a "viable" option. Additionally, Participants A, B, and D stated that their parents expected them to obtain a college degree, but for various reasons. Participant B noted that her mother pushed her to get an education so that, "when I married, I would not be trapped. I could fend for myself if things did not turn out." Participant C stated that her parents did not discuss their expectations for her education.

Future Success

All participants noted that their parents cared about their future success. Participant A stated that her father cared as he, "coordinated tours with coaches at community colleges where I could play basketball." Participant B related feeling that her parents cared, "but their expectations were pretty humble. They just didn't want me doing agricultural work; that's not why they immigrated here to begin with." Participant C stated she felt her parents showed their care by paying for her college tuition and Participant D noted perceiving that her parents cared as, "they took my sister and I to museums and plays and attended school events."

Motivation

The theme of motivation was broken down into two sections: intrinsic motivation and extrinsic motivation.

Intrinsic motivation

Participants B, C, and D all reported that they received good grades during elementary and high school. Participant A also reported mainly good grades but mentioned that she did struggle in a few classes. In terms of pressure to do well in the classroom, Participants B and C noted that the pressure they felt in the classroom was self-imposed. This means that these participants were intrinsically motivated to do well in the classroom. However, all participants felt pressure to do well in the classroom with Participant A noting that it felt more like an expectation to do well in the classroom and not necessarily pressure.

In terms of extrinsic rewards, Participants A and B were offered extrinsic rewards for good grades, while Participants C and D were not. Participant A reported that, "my father promised to give me $5 per A letter-grade. This motivated me to get A's, but I was never given the money." Participant B was taken out to dinner for good grades.

All participants felt that their parents cared about their success in the classroom in one form or another. Participants B and C noted that they believe their parents did care to some degree, but they were self-motivated on their own. This is again a reference to intrinsic motivation as these participants were motivated on their own without extrinsic motivation.

Discussion

In the current study, our hypotheses A and B were supported. As three out of four participants stated that their parents aided in their PhD attainment, this supports our first two hypotheses. However, hypothesis C was not fully supported. There is not significant support for a common theme amongst all women of color in terms of parental support. The only factor that all women had in common was parental attendance at "back-to-school nights" and parent-teacher conferences. This seems to be consistent with findings from Hill et al. (2018) as individuals of different racial and ethnic backgrounds may have different involvement tactics. In terms of cultural differences, we cannot asume that any differences in participant responses are solely because of a difference in culture. These differences can be because of other factors such as parenting style and not necessarily race or culture.

One unexpected topic that surfaced was the concept of marriage. In one instance, pursuing a PhD was seen as a sort of barrier to marriage. Participant C noted a conversation with her parents, stating "When I told them I was going to graduate school, they asked me when I was ever going to get married." Participant B noted that her mother wanted her to get an education so that she would not be stuck in a marriage. While these approaches on marriage are different, they are significant motivational factors in attaining or not attaining an education. The contrast between obtaining an education to have options in case of a bad marriage and between straying away from an education to marry demonstrates the differences that women of color face in society. This appears to be a major factor in parental involvement and support of education.

Another unexpected topic that surfaced was the concept of parental education. All participants surpassed their parents in terms of levels of education. This could potentially be a factor in involvement as parents may hope that their children achieve more than they were able to. This potentially could increase involvement as parents want what is best for their child and hope to help them in ways that their own parents could not.

Limitations

This study used purposeful sampling in order to find " information-rich cases" in women of color with PhDs (Palinkas, et al., 2015). As Palinkas et al. (2015) emphasize, quantitative studies usually focus on findings that are generalizable (external validity), o qualitative studies through usage of purposeful sampling focus on case-specificity

rather than generalizability. In addition, this study also had a very small sample size with four participants. This small sample size also limits external validity as there is not a significant participant pool and findings cannot be generalized to all members of the population. Lastly, this study does not build strong enough connections between cultural differences and these being solely responsible for any differences between participant answers,

Future Studies

Future studies should examine the role of marriage expectations and how these affect parental expectations in terms of education. Specifically, if there is a difference between genders in terms of marriage expectations and education. There is a possibility for differences between males and females in terms of when marriage is expected and whether this is placed at a higher priority than education. Future studies should also examine the influence of parental education on parental involvement.

In the future, a larger sample size should be used in order to form more significant connections and draw significant conclusions that represent a larger proportion of the population. Future researchers may find it richer to conduct both interviews and a questionnaire in order to have two different methods of data collection.

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Gonzalez Alexis

The Effects of The United States Healthcare System: On Low-and-High Income Communities

Abstract

While examining the public and private healthcare frameworks in the United States, TED talks center around the issues that lower-pay Americans/immigrants face, compared to high-income natural born residents. Similar studies also centered around variables like jobs, health care coverages, and language barriers that cause basic human rights of medical care to appear to be a luxury. In the United States, most residents neglect to recognize that specific policy set ups and resources keep specific socioeconomics from getting vital clinical attention. The objective for this study is to examine the obstacle courses that low-pay residents face and the pass into medical care that high-income occupants "naturally" have. A qualitative analysis regarding the insights of pay values, admittance to clinics, linguistics/ethnicities, and assets given by health care coverage/the World Health Organization looks at the benefits a higher-pay natural born resident should receive. These statistics also show the negative consequences your pay has on your ability to being seen by a specialist, the expense of visits and bills, and in general, the well-being of residents. The continuous examination adds to the imbalance we have today in the United States medical care framework regarding ordinary people and their freedoms.

Introduction

Whether you're a current day high-income United States citizen or a low-income citizen, the access you may have to health insurance as well as health care, unfortunately don't involve the same path to access either. Having affordable health insurance not only impacts the care you receive, but also your daily lives, your motivation to maintain a healthy lifestyle, being able to treat health conditions one may have, and completing daily activities that involve going to work or school. Some of the most important factors that play into this broad concept are their regions of residency, their linguistics and ethnicity, the Affordable Care Act, and the low-income socio-economic status no matter where they live and what they do. In the United States, 14% of the population are immigrants, making that more than 43 million out of 323 million, making the United States hold the largest immigrant population in the world. The states with the highest immigration population are California and New York.

The United States healthcare system and its insurance companies favor the wealthy, constantly making the poverty communities suffer. Various studies display the humanitarian issues that are caused by healthcare and how it impacts the high-and-low-income communities. These inequalities cause a threat to those involved and those around the victims as well, causing high rates of mortalities and increase in diseases. Citizens who are part of the lower class or even the center middle class don't have a similar admittance to medical services as a normal local. Additionally, this population will most likely be unable to afford the cost of the medical care or unable to find a new line of work that offers health care coverage due to their language they talk/understand just as the income they make or hours they work. The United States isn't like different nations, for example, Canada and the UK who offer universal medical care to all. This includes a never-ending issue Americans have for instance, the people who have Medicare can have this because our taxes pay for it, but even then, not every person will meet all requirements for it based off properties they might possibly own, their financial status, and employer. I will be exploring the account of the jobs an immigrant/low-income could possibly have, in sight of the language they might talk or just understand, where they lie on the financial status scale, just as the measure of taxes us locals pay, causes a positive or negative result for their access to medical services here in the United States. My two ideas identify with each other because our country highly prides the possibility of opportunity and endless freedoms, however a simple advantage, for example, healthcare has become a long way from simple to get to on because of the establishments in America like private medical care and the qualifications to get Medicare. The logic behind this relationship is that everybody having medical care is essential to assist with any clinical issues that should be covered, or clinical visits also, and no one should need to live without having medical care whether it be clinical, dental, or vision. A cause would be the amount of cash that goes towards the medical care industry and the impact is the access immigrants could possibly need to medical care just as the barriers they face because of it. This then leads me to my research question: How does socio-economic status and linguistics affect health care access between United States low-and-high income families? I will demonstrate this argument by clarifying how unfair our medical care and financial framework has become to innocent individuals, when you compare a high-income citizen versus a low-income citizen, however their citizenship has given them a higher benefit on the platform.

2. Literature Review

2.1 Region of Residency

According to the areas/regions people live in whether immigrants or United States citizens, this plays into factor when accessing healthcare. The elements of physical and social conditions just as the population characteristics impact the wellbeing of these groups. Immigrants, quite possibly the most vulnerable population, have been over and over recorded to disproportionately need health insurance and full admittance to all health care (Aday, 1993). This goes into comparison with US citizens who may live in wealthier, more populated neighborhoods who can afford standard healthcare, even private healthcare businesses. To be more specific, three groups in Hawaii known as: Filipinos, Koreans, and Marshallese have been chosen by the author to study his hypothesis of the regions playing a factor. Each of these groups fall under the category of being Pacific Islanders or Asian Americans, thus their ethnic characteristics play a factor into their profiles and overall statuses, more than 70% of their immigrants have traveled from Asia (Choi, 2009). An important statement needed to be heard is that Hawaii itself has a specific policy that gives the immigrants a different level of assistance to health care than United States born citizens, meaning it'll all be based off how long they've been here in the U.S and their specific community as well. Some of the residents hadn't had healthcare in the past 12 months, Choi would survey the groups he narrowed it down to between 2005-2006 and study whether they had at least one legal immigrant from the country they traveled from, and if they've stayed in the United States longer than 5 years, and in the state of Hawaii for at least 6 months (Choi, 2009). To help accommodate with these findings, they would ask

the participants questions in their language they speak with someone who spoke that language, or in English proving that the language they read and speak plays a factor into their opportunities in life whether they have the accommodations or not. A benefit the responders experienced with this survey was that the author was able to provide surveys in every language they spoke that accommodated to them.

Although there are some negatives there are also some positives, an ethnic neighborhood is a central social space for social interactions and social connections for immigrants. It gives them different the support and assets to meet their everyday needs (Choi, 2009). Their characteristics, that involve their resources, infrastructures, and overall solidarity are what shape the area they live in and what identifies it and will influence their health care and the outcome of it. These residents have learned themselves that they must come together as one and form a strong bond to access these basic human rights and having each other will help with better outcomes. Generally, everyday survival for immigrants relies upon close associations with their ethnic organizations. These organizations are the main source of trust and guidance for new immigrants. As an essential social security net, these organizations give workers advice and direction, key assets, and plenty of resources to address their issues during certain occasions. Additionally, the organizations assume critical parts in medical care access and usage. They fill in as associating specialists for beliefs and information identified with sickness and health like behavior. They will also give data about friendly and helpful administrations, guides like translators and transportation, and guidance for health insurance decisions, and helping the immigrants limited monetary means and linguistic acts (Nee and Sanders, 2001). In the United States, there's never been this idea of having a general mandate for healthcare, and because of this it's been harder for the undocumented immigrants to be a part of an insurance plan; 60% of undocumented immigrants are without health insurance (Monga, 2014).

2.2 Linguistics and Ethnicity

Aside from regions they reside in, the culture they participate in and the linguistics they know play a factor in their health insurance. To help examine some of these issues as well, sociological admins have used literature exams to help them narrow down the study. If there are interpreters available for those who need it, it's a limited amount of those able to. A significant part of the writing on language access and clinical understanding has stressed interpreter related qualifications and characteristics (White, 2009). Less consideration has focused on the job and contribution of medical interpreters in understanding practice. Studies that have been directed on medical providers, however, understand that clinical residents are not taught on the best way to work with translators, and that medical residents underutilize translators, in any event, when they are free nearby (Kronenfeld, 2011). This truly affects their benefit because although there are translators at their disposal, they can't be efficient with them if they aren't introduced or explained as to how they will help them. Studies have shown that literature that is easy to understand will allow the patients to want to participate in healthcare knowing they're understood and won't have to feel embarrassed or ashamed for going someplace that can't understand or communicate with them. Another characteristic of disparity when it comes to health is your race and ethnicity. According to Dr. Williams, we need to consider what we need to do to ensure than every American child,

no matter their race, ethnicity, or socioeconomic status, they need to be covered to be healthy and achieve what is known as: the American Dream (Anderson, 2012). Also, tying in with the region they live in, depending on where one lives and where they go to receive the medical care, they need can play a factor into these disparities. Ever since Barack Obama became the first African American president, many American citizens felt that race in the United States wasn't an issue anymore, they became less interested and supportive to address the inequalities that it never went away. We will not be able to mend these disparities unless everyone comes together as a whole. For these differences to also disappear, we would have to look to more of the broader issue that is the social economic inequalities that appear because of the differences whether you're a person of color or white in the United States (Anderson, 2012). A couple examples of factors that have affected the race issue are the economic crisis and Hurricane Katrina that ruined millions of lives and everything they had. These two events hurt the middle class more than anyone, with their social and employment aspects of life. Along the race and ethnicity issue, there is a gap of knowledge between people of color and the whites when it comes to Medicaid, Medicare, health care and the outcomes (Anderson, 2012). Due to these differences, many immigrants or people of color may go most of their lives without health insurance because they don't have the access or can't afford it, which prevents them from seeking the help they need in fear of an expensive medical bill, or even a $30 co-pay for a visit. A huge downside too is that studies have shown the racial and ethnic groups are the ones who struggle with the highest rates of deaths and illness across the United States, much like we recently saw due to the Corona Virus Pandemic. Economically speaking as well, if these disparities didn't exist it would save the United States health care system billions of dollars (Bustamante, 2018).

2.3 The Affordable Care Act

On March 23, 2010, the Affordable Care Act (ACA) was signed into law by the Obama administration ensuring that almost all the United States residents will have health insurance no matter what, but this is excluding the immigrants who aren't documented. This is an issue within itself, they wanted to provide for all residents, but not the immigrants who are residents, severely hurting their population. Under the Affordable Care Act as an immigrant, you are either, "lawfully present": you're a legal permanent resident, refugee, or a temporary worker with an acceptation as to how long you've been in the United States or "not lawfully present": who are undocumented immigrants who can't qualify for health insurance under the Affordable Care Act. Besides the fact that immigrants contain around 13% of the population, the extent of immigrants is projected to grow somewhere between 2010 and 2050 and crack down to one-fourth of kids brought into the world in the United States are born from immigrant moms, variations in health care access and use among immigrants stays a generally understudied topic (Aragones, 2013).
When it comes to the Affordable Care Act playing a role in this everlasting issue, the variables that play a part and get investigated are Age, gender, race, Hispanic origin, income, marital status, employment status, educational level, English proficiency level, foreign-born status (Chen, 2016). These factors that are listed are critical because this is what holds back an immigrant from progressing in their lives. Studies have shown that the ACA hasn't benefited individuals as equally as it should have; especially those with the lower end of English understanding and the foreign-born (Ye, 2021).

A downfall of the Affordable Care Act is that if it continues to discriminate and cause the disparities with these immigrants, it will be a negative effect even though it has helped many receive health insurance, favoring the non-Hispanics, white men. Just as stated in, "Highly vulnerable communities and the Affordable Care Act: Health insurance coverage effects, 2010–2018", One way disparities can be defeated is if we tackle the social aspects before it reaches the health care system in this country, we can start by providing assistance with learning the English language if it isn't your first as well as improving the health insurance literacy and providing more resources for the non-English speakers: such as providing different copies of paperwork (Park, 2018).

2.4 Socio-economic Status

As of today in the United States, as well as all over the world, citizens in poverty struggle with the rising income inequality that comes along with the drop of wages for those not as skillful, the rise of ethnic and racial discrimination, and events that leave them undocumented. Immigrants travel and want to stay in the United States ultimately for a better life for themselves and their kids they are raising. Out in society, immigrants become part of lower-income communities and are fearful of stepping out of their comfort zone to try new things such as new areas to live in, new jobs, and new languages to speak. Especially for the first generation of immigrants, new linguistics, culture and social change were super unusual (Hirschman, 2015). It's super common for the immigrants to want to settle near their fellow immigrants, go to those specific social events as well as places of worship (Portes, 2014). With, the second generation was able to learn English as their first language from being raised in the states and were determined to join the socio-economic status that existed and not so much their parents' foreign cultures (Alba, 2003). Ever since immigrants from all the world have settle in America, they've been a huge population apart of the working class, but still suffering with their wages they earn. Their impact alone on the labor market has helped the economy grow locally and nationally, increasing sales in producers and consumers. An economic issue in this country that also keeps native born and immigrants apart is that; in 1997 an NRC report stated the findings that the average native-born household in the state of New Jersey and California pay more in state and local taxes because of the immigrant population. This is because of the lower wage's immigrants have and the demographics of their households since they may have more people to support than Americans which is common, as well as the smaller benefits they have for school (Smith, 1997). Economically speaking, immigrants/low-income contribute more to taxes than they ever will receive, the younger generations of immigrants may not be able to receive the benefits of social security in the future as well as Medicare, and Medicaid for certain people. An unfair statement is that the hard-working immigrants are one of the main reasons as to how we relieve the per-capita fiscal burden of the native born when it comes to national debt, as well as goods and national security; concluding that immigrants have helped more than they have hurt this country (Smith, 1997).

Schools, hospitals, and social services offices might need to provide interpretation administrations and other uncommon programs for immigrants. In any case, many of the expenses are paid by the immigrants and their families. Immigrants have given up their commonality of home as they continued to look for a better life and more noteworthy freedoms for their kids. Immigrants should also receive a fitting society that may be

undecided, and occasionally unfriendly, to their presence (Hirschman, 2015). Native-born Americans and immigrants are different from one another for obvious reason such as: the language they speak as well as their religions. In more depth, immigrants have been over-represented among college graduates and K-12 education when you compare them to native-born Americans (Feliciano, 2005). On the bright side they are becoming more successful in skills and education. The parents work hard to allow their kids to have a bright future, even if it means working at a job that they are overqualified for. Because of their parent's hard work and determination, as the kids grow older, they tend to pick up off the determination and want to be successful themselves. Studies show they tend to do very well in school with earning above average school test results, less likely to drop out of high school and more likely to earn a degree than native-born United States citizens (Fulgini, 2004). In a more known sense, immigrants may also be over-represented when it comes to celebrities, such as top artists, award winners, as well as educators. They have truly made an impact on education, music, movies, art, food, and overall society. Immigration has become, the most unmistakable element of American character. Immigration has disproportionately affected the demographic size, ethnic variety, culture, and American culture. Immigrants and their young generations have accustomed to America, and they have likewise formed many American establishments (Briggs, 1984).

In conclusion, as immigrants are becoming adapted to the country and a big part of this country's growth, it still isn't working in their favor. Immigrants must compete with native born Americans for a spot in high education, jobs, and even to fit into society (Hirschman, 2001). Unfortunately, today it is common that high, successful businesses are open to the idea of accepting people who don't have connections, good social skills, or even a degree of some sort (Duncan, 1968). All these obstacles have either made immigrants fearful to try or eager to try and determined to be successful in society because of their past generations. Immigration has changed America in ways many wouldn't think, they have opened the job force much wider to fellow immigrants and allowed more chances and opportunities to open for those in the same fields. Although these factors: of their regions of residency, their linguistics and ethnicity, the Affordable Care Act, and the immigrant's socio-economic status no matter where they live and what they do, have hurt them in growing as well as receiving health care, progress can slowly be made as well.

Methodology

In using qualitative analysis to achieve the results of this thesis, it'll examine different observational field work that connects to my 4 different ideas about the unequal access to healthcare in the United States. I would like to perform a qualitative content analysis to uncover common themes discussed by speakers of the TED Talks of interest which will involve case studies that are personal experiences from different point of views focused on the healthcare process whose questions are informed by those themes. The main goal of this thesis is to find how different it truly is for a wealthy citizen in the United States to afford health insurance and be treated and exploring how lower income navigates a healthcare process that they are excluded from. As soon as the interviews and ted talks have been finalized and gone over, I will be able to compare the two differences as time has gone by.

The 4 different topics about this issue look at: the region of residency, the linguistics and ethnicity, The Affordable Care Act, and the socio-economic status of immigrants and American citizens. I will also be looking at how individual, lived experiences described by the speakers I analyze and the interviews I analyze as well as well as articles. These issues are very important to look at because they all tie into how accessible health care is here in the states whether it be due to where you like, how much money you make, or even the language you speak. To look more into depth, this thesis focusses on the citizens themselves regardless of their backgrounds ethnically and socially. To the case studies, ted talks at a decent time range I will have to set a time frame from 2000-present day. This large time frame will show us the differences in the past all the way to today, comparing past issues and today and how they have been solved or not.

To understand the results of this thesis, you will need to understand what these differences are, and how they affect. I would like to observe whether the speaker's state, language, ethnicity, and socioeconomic status affects the themes and messages from their TED talk/interview. Lastly the Affordable Care Act created by the Obama administration plays a big factor because it was an idea to cover medical insurance for all, except the immigrants. Having health care insurance is a huge advantage and privilege in life and present in our everyday lives no matter where you are. We can look back on when health care insurance started and what it did and who it helped in the beginning as how it has changed over time. In 1906 the American Association of Labor Legislation (AALL) pushed for a campaign for health insurance. The goal was to limit coverage for those in the working class or those who earned less than $1200 a year, with their dependents. This bill from 1915 also included services for those who worked in the medical field such as nurses and physicians, while considering their sick pays and benefits. The American Medical Association supported this bill introduced by the AALL. Although health insurance truly began in the 1930s with the Great Depression. The Great depression pushed for hospitals to implement insurance as a payment for their treatment or visits.

Medicare was introduced in 1965 following World War 2, to ensure that the older citizens had coverage. This then cause private insurers and regular commercial ones to compete for customers and to provide lower rates that people can afford and that'll bring in much more revenue as well. Slowly by the time the 1980s rolled around, it came to realization that health care costs were increasing at a rapid pace. As time eventually went on, health coverage never got cheaper, in fact in 2000, due to the rising rates they wanted citizens to pay more for higher deductible health plans and better health savings accounts. Which then followed in 2010, the Affordable Care Act, a goal to change the United States health insurance market. These couple statements are an issue, having individuals pay more money for better coverage in the long run, can't always work. Some low-income citizens, if not all aren't able to use their spare income on health insurance, they use it on more of the essential things they need such as food or bills to survive. Also, some may not have the job that offers them medical insurance at a discounted rate, or they don't have a job at all to get them exposed to these kinds of benefits.

These four ideas were chosen to allow me to prove this thesis for the following reasons. First and foremost, to establish the differences between the poor and the wealthy and how these four factors truly divide these two groups of individuals and how they

truly affect their everyday lives and how they go about receiving medical coverage. These are also crucial to help us look at how they country can do better and improve to accommodate for those living in the United States as they are a government by the people and for the people. It can also prepare us for years to come and health insurance modifications as well, since the United States has always been a fast-moving country that constantly wants to develop and improve in any way it can. Although, each concept is a little different from one another and the different aspects of each other's lives, they all fall under the umbrella of the "How does socio-economic status and linguistics affect health care access between United States low-and-high income families?". We must take these issues into account during our results to come to consider an equal service for the results to be represented.

Results

Existing TED talks reveal the lack of access and equity that exist within the United States healthcare system, and how it falls behind so many other industrialized countries even those who aren't so industrialized, who still supply their citizens with equal access to affordable healthcare. Specifically analyzing the role of socioeconomics and race in American healthcare, many scholars argue that low-income citizens/immigrants are unsatisfied with their medical visits and care when compared to a higher income natural born citizen. Therefore, fueling the issue of health inequity: an ingrained unjust barrier that are preventing areas of the population from accessing a high level of health. The TED talk organization and everyday citizens have analyzed ideas such as health inequity, healthcare being a "luxury", how the healthcare system views you, and overall, the health disparities based on race and income, which have slowly gone from topics to discuss about to the lives people are living under the United States health care system. Specifically talking about lower income communities and immigrants who struggle to live off a wage to access healthcare, the TED talks provide a notable amount of information regarding the issues beneath the healthcare system, in the socioeconomic system that have become involved in these innocent lives.

In a TED talk from 2016 speaker Kathy Hull presents her findings and stories from terminally ill children who live in the George Mark Children's House. She shares her experiences from this caretaker facility that aims to focus on the quality of life and continue to care for children who have illnesses that today's healthcare can't cure just yet. The rooms within this home are quiet and comfortable for the children, rather than a noisy hospital room surrounded by citizens of all ages (Hull 2:25). Death amongst humans is tough to experience and to talk about, but death amongst children is something every parent fears. A young girl named Crystal entered this home with an inoperable brain tumor. She was given moral support by the caretakers on site and a nice place to stay for herself and her family (Hull 5:30). During her time spent there she slowly progressed and lived past the timeline the doctors had originally given her. This then goes to show that hospice care for children is an important factor that is missing from our healthcare system. A home like this is only a third of the cost compared to a hospital room and should be offered to more citizens. This is a non-profit business that is funded by supporters and doesn't send a bill to the families that seek help (Hull 9:30). A hospital has become more of an institution rather than a place to get medical treatment. Most low-income families here in the United States don't go to a hospital

because they can't afford the medical bills, or don't have insurance to cover them. As citizens, as stated in this TED talk Kathy mentions that we look up to our healthcare system to fix issues like this to help keep Americans alive and to provide affordable healthcare, but we seem to be let down economically (Hull 10:13). Kathy Hull has taken it upon herself and the amazing partners of hers to create a comfortable environment for those children who are nearing the end, it is common for a kid in a high-income community to receive "luxury" healthcare treatment because they can afford it, but low-income immigrants, not so much. She also presented a diagram showing that in the UK, a country smaller than California provides more than double the amount of child hospice centers than the United States does, as a free healthcare system. Where does all this money go to that we use to pay for health insurances for ourselves and our families (Hull, 2016). Hospice care can be something certain people can afford, or their insurance covers a portion, versus some low-income citizens and immigrants who fear the price of these resources.

Regarding a more personal experience, Scott Williams the Vice President of Global Patient Advocacy discusses his personal experiences with Lyme disease and how one specific caretaker made all the difference. Scott Williams argues that without the informal caregiver he was treated by the healthcare system would crumble. Whether it being the growing number of populations or the economic instability, the care for patients with long term chronic conditions, should be more than ever (Williams 2:30). Just as argued within this paper, American citizens struggle and sacrifice some of their necessities to be treated, and it turns out some healthcare workers may do the same. For example, nonpaid caregiving is what creates this struggling foundation in the United States healthcare system, and slowly leans on the citizens income to fix the issue. Caregivers also help provide emotional support, help with finances, and help schedule doctor visits, yet not everyone has the access to them. Scott Williams himself has created a company that works to support employees and society in healthcare. He argues that society today faces increased health obstacles that include increasing numbers of health conditions and large gaps of inequality amongst all (Williams 7:08). Policymakers must look past traditional healthcare paths and consider informal/affordable care to support the helpless millions of Americans struggling to find affordable healthcare. We need a societal change, yet this can only be possible from those who are willing to make a change (Williams 8:45). Most policy makers will only look to better the lifestyles they live, for example the higher income and more privileged health care they receive. We need policymakers who will consider lower income residents and will consider providing them with better healthcare access.

It is inevitable that if you are a part of the higher class in society, the cost of a medical bill and the cost to feed your family doesn't concern you. On the other hand, those in lower income communities who can barely afford a home or can barely afford the food in their fridge, must second guess the healthcare treatment that will cost them double the income they make. Compared to the White population in the United States, twice the number of African Americans have a higher rate of dying from diabetes and breast cancer due to the treatment they can't receive. Kerri Norris, a previous health scientist for the Centers for Disease Control argues that health disparities are hurting our community and the answers to these issues are hiding in plain sight (Norris 1:19). Where you live dictates how you die rather than past health history from your family. The gap of inequality in healthcare continues to grow further and further apart. Our healthcare system is lacking equity

that helps low income get back on their feet. Kerri brings up a strong argument that most of the healthier foods and ways of maintaining a healthy lifestyle cost money, and that some people may not be able to go outside to exercise because it isn't safe where they live (Norris 7:40). Inequality in the healthcare system begins early on in a child's life. A white child may have access to therapists to help with their mental health and to get the intervention they need to avoid diseases in the long running, but this doesn't occur in low-income communities.

From a doctor's point of view, I would like to talk about Paul Thomas a family doctor in Detroit and his point of view about the medical bills people pay. Most people are on fixed incomes with Medicare, and it is very common that people will wait till the very last minute to be seen by a doctor for whatever the reason may be. Paul mentions a citizen who received a medical bill for $350, and he soon realized his Medicare only covers primary care, rather than special care. Paul himself, even knows if someone were to develop a medical issue, they may be hesitant to talk about it because of a medical bill they may receive in the mail, just like his own grandpa for example (Thomas, 3:28). Paul himself has experienced medical visits with low income and families who have no other choice but to go to a specific medical clinic because of transportation they don't have. Paul went to school in Detroit before he slowly realized how medically underserved the population of Detroit was. There were about 100 primary care doctors for the 680,000 people who lived within a specific area, meaning 1 doctor for every 6,000 people (Thomas, 5:15). Paul realizes how hard it is for patients to be seen by doctors or to even be understood, as his basic training went on during his career, he lost touch with so many patients which causes people to be unmotivated to be seen. It wasn't long before Paul realized he should join a group of direct primary care doctors who believed healthcare should be affordable and accessible for everyone. They work directly with the patients, and they don't require insurance, and they make enough time for patients seen 5 a day with 1 hour time slots for each, whereas the typical family doctor in America has nearly 2,400 patients and will see around 24 patients a day. There has come to be about 700 direct primary care doctor clinics across the country, and they get medications at wholesale and the original cost of imaging which helps their patients save thousands of dollars a year on each of the medications if necessary (Thomas, 7:48). It is doctors like these, who go out of their way to take care of patients the way they should be taken care of, and they are the ones who will help make United States healthcare more affordable for the lower-income communities. These doctors are saving their patients and saving medicine as well, it is very unfortunate that even doctors, who get paid well to only take care of the patients they get around to seeing, truly do care about the well-being of their communities and how medical access is hard for most lower-income citizens.

On the other hand, Johnathon Gruber a Health Systems Architect provides us with a detailed talk as to what the next steps are for healthcare reform. He himself mentions the story about Andrea, a stay-at-home mom who was diagnosed with breast cancer, although thankfully her husband had good health insurance coverage that she was able to receive the treatment needed. He also mentions Verda, a single mom who noticed a lump in her breast that her state funded insurance was able to cover the cost of the removal with surgery. Yet later down the line when Verda got a job as a waitress, she didn't have healthcare insurance, therefore when she felt the same symptoms, she was fearful of going to the doctor because she didn't have insurance to cover the cost.

Unfortunately, like I mentioned previously within my literature review, she waited too long to get it checked out, her symptoms got worse, and her cancer spread rapidly throughout her body. Thankfully Andrea is cancer free and survived, unfortunately Verda died shortly after her ER visit regarding the pain and symptoms she was feeling (Gruber, 2:01). Both women were diagnosed around the same time, live in the most advanced country on Earth, but they live in a country that doesn't guarantee health insurance for all, or it does but at what cost. Johnathon brings up a good point that this brings up the disparities in health outcomes and financial protection in the United States. As I have talked about racial disparities connecting to my literature review as well, Johnathon Gruber brings up an example that a white child who grows up in America today has the same chance of seeing their 1st birthday as a white child in Europe. Yet a black child in the states has a lower chance of meeting their 1st birthday compared to a child in Libya (2:39). Referring to my Literature Review and the affordable care act, before it was put into place 80% of Americans had good health insurance, including Johnathon and his wife. People were ablet to receive this through their employer or even government programs such as Medicare and Medicaid that we are all familiar with today, yet it wasn't accessible for everyone because the cost may have been too much, or the providers were limited. This then dropped the other 20% of Americans into a discriminatory non-group insurance market that is completely legal. This market let the insurers discriminate against the sick for numerous reasons: they could have denied the sick coverage, charge them more because they're sick, or ignore their pre-existing illnesses for coverage (Gruber, 3:50). In sum, the healthy people didn't have to worry about health coverage, but if you were sick like Verda, you were out of luck. The purpose of health insurance is to protect us from paying thousands of dollars for medical visits and procedures, rather its costing you more. This sparks a fear in citizens as well because they are scared to lose their job because with that comes the loss of their sponsored health insurance from that employer. Republican Representative worked with Johnathon Gruber in developing a way to make sure everyone in the state of Massachusetts would be covered by healthcare. He mandated everyone get health insurance therefore the market insurers won't have to deal with sick citizens, and everyone will be considered healthy and covered, (Gruber, 7:04). Therefore, in Massachusetts they passed a reform in the Spring of 2006 that would ban discrimination and ensure coverage which resulted in this state being the first in the United States to provide a universal health insurance coverage law (Gruber, 7:48). The economic research Johnathon has found that because of the Affordable Care Act, the numbers of those uninsured dropped and citizens are more likely to receive the regular care and checkups that are needed. It is noted that the federal government does provide tax credits for those struggling to afford healthcare, yet even then they struggle to afford the price of insurance coverage. Connecting back to my literature review, the Affordable Care Act has also failed some citizens because some states weren't accepting the expansions of Medicaid, which is a state-run program, yet under the ACA the government agreed to pay all if not most of the costs to insure the lower income (Gruber, 12:59). Yet, the biggest impact of the Affordable Care Act and the states cooperating all had to do with political viewpoints and parties. Every day, millions of Americans are falling into a trap because of finances or changes in their lifestyle, yet expensive private insurances are wasting tons of money a year that can be put into healthcare for all. There are plenty of practical options to make healthcare more accessible and affordable to all, yet politics and our government differences cause larger obstacles to get there.

Regarding a more personal experience, an undocumented immigrant by the name of Denisse Rojas explains her experience with American healthcare. She begins by talking about in her first year of college at the University of California, Berkley her mother started experiencing some medical problems. Her mom was told by a doctor in the emergency room that she needed surgery, although the worry on their mind was that without health insurance, this surgery would almost be impossible (Rojas, 2:58). When her mother would apply for health insurance, she wouldn't ever be accepted, this unfortunately left her with no choice but to immigrate to Canada where she got a job and healthcare to get rid of her fear of cost of healthcare. Because she was being constantly denied of healthcare, it made it impossible for Denisse's mother to live here in the United States. Denisse Rojas supports my argument by stating that undocumented immigrants and low-income citizens don't have access to a basic human right, being able to live a healthy lifestyle in the most advanced country in the world, the United States of America (Rojas, 4:37). Dennis advocates for undocumented immigrants and their equal access to healthcare in the states. She and a couple others started a group called Pre Health-Dreamers, and their mission was to be able to help undocumented students be able to pursue a career in science and in health (Rojas, 5:39). Unfortunately, an important role in this group was to understand where undocumented immigrants were able to apply for medical school and what opportunities they had to advocate, although they quickly learned you didn't need a social security number to apply to medical school. Dennis and her team did everything they could to visit health clinics and offices to learn more about the regulations and to be able to pass it onto their students. A very important fact I would like to include is that her team worked with California Senator Ricardo Lara to pass legislation allowing undocumented students the ability to apply to a health license (Rojas, 7:02). During her time and taking care of patients, her team helped a patient who experienced blood clots in her lungs, they were able to stabilize her with the help of medication afterword's and follow-up doctor visits. Unfortunately, they learned this patient didn't have health insurance and she wasn't provided it because of her immigration status. Dennis argued that the physicians she worked with didn't know how to take care of an undocumented patient in the system, especially since there are over 11 million immigrants and more than half don't have health insurance (Rojas, 8:51). There are clinics and hospitals available for the lower income citizens, yet they lack resources, and this is what the immigrants are depending on for care. She argues that in becoming an American physician they are being taught that the poor aren't as deserving as the rich are, yet this becomes a political issue when trying to make positive changes and dealing with a bureaucratic system. Vulnerable communities shouldn't have to go through what Denisse and her family went through due to her mother's ability to receive health insurance. Families in America, regardless of their economic and social status shouldn't have to pick between family and medical opportunity.

In a final personal experience, Mitchell Katz is a doctor who explains the point of view of a citizen who experiences trauma, and how they normally will not go get the help they need because they don't want to relive the trauma. He has noticed himself that healthcare has been built on a middle-class model that doesn't even meet the needs of those in the lower-income communities, (Katz, 2:29). He argues that this is making it an issue to close in on the disparity in healthcare that exists because of the economic guidelines, even though health insurance was expanded during the Affordable Care Act, as mentioned previously. It is not easy for citizens to take time off work to go even see the doctor for a checkup, for

example Mitchell mentions a patient went into his clinic for partial blindness and waited days before he went to a doctor because he had to work to pay for his rent (Katz, 3:34). It seems to be that healthcare in the United States assumes we can all afford to miss a day of paid work, we all speak English, or illiterate like I mentioned in my literature review, or had the resources to get to the doctor's office from their homes, Mitchell agrees. Lower income citizens tend to have to move from one place to another therefore, if they receive letters in the mail regarding a doctor visit, they don't see them. A big flaw about the United States healthcare system, is that they assume all residents have a steady income and a steady supply of food for their household. This is a critical issue because if you have an illness and are given medication, you need to have a good intake of food throughout your days (Katz, 7:05). Health care also assumes that everybody has a home and a place to sleep at night, a fridge/pantry to store your medications at the desired temperature, and a place to rest and wash up at night. It is much easier for the higher-income citizens in the United States to be able to prioritize their health while being able to maintain their steady lifestyle. All of these mishaps that go on in a lower-incomes lifestyle can't seem to be fixed because the lack of resources they are provided with, any other class above, has all of the resources that they need. We have seen over the years that the life expectancy in the United States is significantly decreasing upon generations. When the healthcare insurance companies make assumptions as I have stated previously, they make it much harder on people to believe that healthcare is a right, rather than a privilege for the ones who can afford it. There are ways we can make healthcare more accessible; it would have to start with meeting these lower-income families in the middle and providing them with their needs without adding more obstacles in their paths. Taking care of yourself starts at home, and surrounding yourself in a good environment, it is hard to treat someone when they are either homeless or don't have a steady lifestyle (Katz, 12:06). Those who are financially stable don't need to worry about missing a day of work to see the doctor, a private insurance company doctor rather. Their route to be treated is much simpler unfortunately, but lower-income communities can't afford to add monthly expenses of healthcare to their bills.

As a matter of fact, after reviewing these case studies and listening to different point of views regarding the United States Healthcare system amongst low-and-high income communities, these stories answer my research question by supporting that socioeconomics and linguistics do affect your access to healthcare. From doctors' points of view who see the ins and outs of what patients go through daily, to how successful citizens are trying to make a difference and help, compared to how citizens have experienced the hardships and unfairness on their own by sharing all types of experiences. I also specifically chose to analyze TED talks from doctors that aren't from the same state, to get a better understanding and to prove that there are doctors who agree that healthcare lacks equal access and lacks an affordable cost. There are some doctors who do want to see a change and are working for their passion rather than the checks they are receiving on pay-day. Within the results I furthered my research in arguing that there are differences between low-and-high income communities when it comes to the United States healthcare system. As hypothesized earlier, I expected to find case studies that are for making healthcare more affordable and do understand how unfair it is and how privileged the higher classes are compared to the lower classes nationwide. By analyzing TED talks, the nonprofit organization, that provided short powerful messages for people all over the world and covering thousands and thousands of topics, it made my search easy with just the click of a

button on a single website. As talked about in Denisse Rojas talk, modern doctors seem to understand the true issue and the lack of equity that falls under healthcare. Multiple talks are arguing the same thing, these health disparities are hurting our communities one patient at a time, citizens aren't health enough to achieve the American dream, and even because of your skin color, you may have had better resources as a younger kid.

These results also support my argument that some citizens will only work a certain job because it comes with the benefits of having healthcare insurance that will cover yourself and your family members. I can say with certainty that these case studies have successfully supported my argument. Moreover, in Mitchell Katz's talk, he argues that we can make healthcare more accessible, it just comes with a cost, economically. Each case was different in how they viewed the healthcare system, or what some speakers may have done to improve it. For example, Kathy Hull and her team have created non-profit organizations that are like a hospice care and are offering moral support for patients who can't afford to spend weeks, days, or even months in a hospital bed because of the cost that comes with it, with George Mark's Children home the patients don't pay a dime. After gathering information from Kerri Norris' speech, I learned that any past health issues/disabilities that are carried down from generation to generation are affecting your health and it is completely out of your control. Some of these longtime illnesses, such as Cancer come with long term treatment that comes with expensive medical bills as well that your insurance may not be able to afford, can only afford part of it, or you don't have any healthcare insurance to help treat it. I also learned from analyzing these talks that some young teens/young adults will go most of their childhood and young adulthood without having any healthcare insurance because of the ability that their parents/guardians had to pay monthly, or even apply for Medicare in the state they live in. After analyzing each of these results, the most significant and practical way we can fix these issues start with public policy makers and our government officials, yet within the governmental parties, there are divides that involve healthcare in the United States and how it is distributed as well as its cost. The United States is the most advanced country in the world besides healthcare, and the government provides a surplus of money for healthcare insurances to use, yet they are choosing to provide better resources for private insurance/people who can afford insurance, versus people who can't and have to enroll in Medicare when the enrollment opens at the end of the term. The same incidents happen to all citizens no matter their ethnicity and economic status, anybody can develop an illness, although if you're a part of the middle class or higher, your doctor's will have the resources to treat whatever your needs are. Mr. Katz believes we must meet the patients rather than them coming to us, for example, he can't treat a homeless patient who doesn't have the resources at home that can support their care, the first step to care that they need is housing (Katz).

Conclusion

Based on this case study analysis, the United States healthcare system neglects low-income families and constantly cater to those who aren't really suffering. This thesis suggests that those who live in a city that is less fortunate and the residents don't make a livable wage, that your chances to live a healthy lifestyle are slim compared to a higher-income citizen. It also suggests that health insurances do have the correct resources for all citizens who qualify, yet they supply middle- and upper-class families with most of it.

As demonstrated, most low-income citizens were once immigrants who came to the United States for a better lifestyle, or still are immigrants, yet to live a better lifestyle and live the American Dream they must be healthy, and healthcare is preventing that from happening. In addition, our government affects the regulations that the healthcare companies put into place that become necessities for citizens. Also, insurance companies work with the government and are reimbursed for their services. Just as I mentioned Medicare, the governmentally funded insurance did allow for more citizens to access healthcare and have coverage, yet it isn't quite accessible for all, and just adds to more taxes taken from bank accounts. When diving into the relations between healthcare and its patients, there is an existing issue with racial disparities, the care for minorities is reduced based off their race. We have learned over the years that your ethnicity does also affect the illnesses you may develop from past ancestors, and it occurs in more non-Caucasians citizens.

The case studies helped me realize that more advanced cities prioritize healthcare than non. Information about these personal case studies have been made publicly on the TED talk website as well as the company's YouTube channel for viewers to be able to watch whenever. Although, there are resources to help low-income families, they are financially vulnerable and don't have equal access to see a doctor, get to the doctor, get medications, or even have insurance to cover all their medical expenses. The individuals with a relatively high income have an advantage at a healthy lifestyle and preventing long-term illnesses because they can receive check-ups and body scans beforehand, they also may be able to choose the doctor they would like to work with, the days of their appointments, and times, as well as where they can be seen at. On the other hand, those with a relatively low income, don't have this much freedom and are restricted, they may not get to pick where they can be seen at or who their doctor is, they get stuck with whoever is located within the area they reside in, an area without prioritized healthcare. The largest disparities that were found between the low-and-high income communities were the differences in the quality and access of healthcare. These issues just create larger moral problems for the United States healthcare system. The United States has some of the most advanced machines for medicine, develops vaccinations quickly during difficult times, and has some of the best doctors in the world, yet they make it seem impossible for some citizens to access. Referring to my mention of the American Dream, the United States healthcare system is the foundation of all aspects of life such as: opportunities, social justice, and overall, the economy (Riley, 2012). The clearer disparities are involved in minorities of the ethnic groups of Black and Latino citizens, and very rarely in Caucasians. The life expectancy rates are much lower in African American and Latino groups, which also affects mortality rates when it comes to babies and the African American and Latino groups are much higher than white babies. Along my time of doing research, I have learned that our healthcare system is so unequal because we are a country who relies on private government, the poor seem to just be getting sicker because they don't have equal access to get better.

Therefore, after completing my thesis, I have considered Universal healthcare that can make healthcare in the United States more accessible. To begin, it is a system in which all citizens of a designated area or country are guaranteed access to healthcare. Its main goal is to provide all residents with healthcare, especially those with lower income. The government already pays for healthcare insurances such as Medicare that lower income citizens can apply for, therefore they should be able to provide Universal Healthcare rather than spending money on institutions that aren't benefitting their citizens. This form of healthcare can especially be beneficial for Americans because it'll reduce the cost, they pay a month to be covered by health insurance, especially those who have private insurance coverage such as Kaiser. As I have mentioned before, the United States is so advanced when it comes to healthcare and has a growing economy that they should have Universal Healthcare just like countries overseas who do and are doing just fine. Doctors in the United States make a good living and can live comfortably because of the payments they receive on such little treatments for their patients. Also, this will benefit the economy because they will be able to get medications at a larger supply for a cheaper cost, and overall better pricing outlines for medical clinics. I have mentioned before that the insurance companies favor to the wealthy, higher-income communities therefore there is a competition between insurance companies and who their target audience is. Stated in one of the TED talks I analyzed; all the for-profit insurance companies care more about if the patient can pay for the treatment rather than the care they will provide for the patient. I would like to argue that overall, a Universal Healthcare system will work in the favor of younger children, because they will be able to receive the respected care and treatment that they deserve to live a healthy lifestyle and achieve the American Dream. At a young age, if a child receives adequate health care, it is less likely they will grow up and make poor decisions. Young children who grow up in Caucasian high income families have an advantage to the routinely checkups which puts them at an advantage over children of color and in poor families, therefore Universal Healthcare will make this opportunity equal for all. This will help advertise more rights and equality in healthcare and will remove the fear of patients who fear an expensive medical bill they can't afford at the time.

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The Survival of Healthy (Tau-) Neurons in Tau-stained CA1 Region of
Nondemented Individuals (NDAN) with Alzheimer's Histopathology

Abstract

Non-Demented Alzheimer's Disease (NDAN) individuals are characterized by having Alzheimer's Disease histopathology of amyloid plaques and neurofibrillary protein tangles made up of Tau proteins but not suffering from dementia. We analyzed brain tissue samples in an area of the hippocampal subfield called CA1 which is an area that is sensitive to cognitive decline and demonstrates significant neurodegeneration caused by Alzheimer's Disease. We counted and measured healthy neurons in the CA1. We correlated the number of healthy neurons in these sensitive areas with people diagnose with Alzheimer's Disease but were not demented (NDAN). Tau was specifically analyzed to confirm that the tissue samples that were analyzed, originated from individuals that suffered from AD histopathology. Comparing the Tau-stained hippocampal tissues from AD, NDAN, and control cases we observed that the number of Tau negative (Tau-) healthy neurons were present in AD cases, but significantly higher in NDAN, and in controls. In contrast, Tau positive (Tau+) presumptive unhealthy neurons were most prevalent in AD and NDAN cases, but far less numerous in controls. The decreased number of healthy neurons found in AD cases and increased healthy neuron presence in NDAN cases might provide an explanation as to why NDAN individuals did not suffer from dementia. These observations are consistent with HIF2A results described by Vivianne Mitri in her recent (2020) thesis "Overexpression of HIF-2a in Protected Regions of Alzheimer's Disease in Resilient Cases".

Introduction

Alzheimer's Disease based on NIA-Reagan histopathology criteria is defined by the amount of and extent of distribution of amyloid plaques and neurofibrillary tangles (NFTs) in the brain at autopsy. However, the clinical diagnosis of Alzheimer's disease along with includes the expression of cognitive decline or dementia. Since about 60 to 70% of individuals who have dementia are also diagnosed with having AD histopathology, Alzheimer's disease is often described as the leading cause of dementia. Until recently, most people assumed that if a person had Alzheimer's Disease, they also suffered from dementia. However, recent studies have demonstrated that there are many individuals who had led normal productive lives (such as some "superagers" or individuals in the 90+ study) and were cognitively intact at the time of their death, expressed all of the hallmarks of Alzheimer's disease histopathology upon autopsy. Individuals that have the histopathology of Alzheimer's Disease but did not suffer from dementia are referred to as Non-demented individuals with Alzheimer's Disease or NDAN. Individuals with Alzheimer's histopathology and dementia are referred to as AD individuals. The reason CA1 was selected for the present study is because of its selective vulnerability to neurodegenerative conditions such as hypoxia, vascular disease and Alzheimer's disease. One of the reasons for CA1's selective vulnerability is likely due to its relatively low oxidative metabolic capacity as determined by cytochrome oxidase histochemistry (Kageyama and Wong-Riley, 1982). There is now evidence that CA1 pyramidal cells have the ability to overcome their relatively low oxidative capacity by undergoing a metabolic reprograming associated with enzymatic changes involved with hypoxic adaptation (Mitri, 2020 - Kageyama, advisor).

Tau

Tau is a microtubule associated protein (sometimes referred to as MAP tau) that polymerizes to form neurofibrillary tangles (NFTs, Ittner and Gotz, 2011, Scheltens et al., 2016). One of the areas of the brain that appears to be the hardest hit by Alzheimer's histopathology, is the CA1 region of the hippocampal formation. There have been many descriptions of amyloid plaques and Tau-based NFTs and its involvement with CA1 in Alzheimer's Disease, but there has not been an analysis which includes cell measurements and cell counts of Tau negative healthy neurons in Tau-stained tissue preparations. Most reports have claimed that many neurons in CA1 had shrunk or degenerated in AD, but few have reported the numbers of healthy neurons that remained. In order to determine if the number of healthy neurons in cognitive processing areas of the brain could be related to cognitive health of the individual, the present study involved an analysis of the relative numbers and sizes of both AD-afflicted Tau+ neurons, and presumptive normal healthy Tau-negative (Tau-) neurons in the CA1 region of the hippocampal formation in AD, NDAN and normal control brains. The present study not only confirmed previous AD findings in literature but also provided evidence that amidst the presence of abundant Tau histopathology in CA1, a significantly greater number of presumptive healthy Tau-negative neurons were observed in the nondemented (NDAN) cases compared with demented AD cases in the CA1 region of the hippocampus.

Methods:

Formalin-fixed paraffin-embedded (FFPE) 6 μm slide mounted tissue from postmortem human subjects were obtained by Banner Sun Health which was then sent by NDB Bio for immunohistochemical processing. The AD, NDAN, and control tissues were stained with an antibody to phospho-Tau, which is used as a marker for AD histopathology. In Vivianne Mitri's work she mentioned that HIF-2a in the nuclei was stained CA1 neurons which are known to be protected in NDAN. With the training of Dr. Kageyama and Ayah Elsamad the researchers took on the analysis of the immunohistochemical data, by identifying and counting Tau positive (Tau+) and presumed normal unstained Tau negative (Tau -) neurons in the tissue samples. Then cross-sectional neuron diameter measurements were obtained. In order to maintain the integrity of the results this was conducted as a double-blind study. The scanned digital images for this research were exclusively from the CA1 region of the hippocampal formation. Students were trained to distinguish neurons from other cell types in the CA1 region of the hippocampus. Other cell types included glial cells, such as astrocytes, oligodendrocytes and microglial cells, and vascular cells, such as the endothelial cell, pericyte, smooth muscle cells and fibroblasts. The Tau+ neurons were subclassified as "D" for darkly stained, "M" for moderately stained, "L" for lightly stained, and "Tau-" for normal unstained healthy neurons, and were also counted. Next, the ten most prominent healthy Tau negative neurons were measured from each image in millimeters (to the nearest 0.1 mm), and then converted into microns. Ayah Elsamad then collected the data from the researchers and was made aware by Dr. Kageyama whether the tissue sample examined pertained to AD, NDAN, or control and then created a quantitative analysis from the data collected from the CA1 Tau counts, categorized them appropriately and obtained the average and standard deviation of each slide and then each case with both the cell measurement and cell count. Our research derived our information from

nine cases overall, three of them were AD, two of them were NDAN and four cases pertained to our control group.

Results: Cell counts per standardized sample area (200,000 µm2)

When comparing neurons in AD, NDAN, and control, the mean number of presumptive healthy (Tau -) neurons were the lowest in AD cases, higher in NDAN and highest in control per standardized sample area of 200,000 µm2. When looking at Tau - in AD we got a value of 4.67 ± 5.59, for Tau+ in AD we got a value of 19.65 ± 4.98 in total for AD the value was 24.32 ± 7.89. For NDAN Tau- we got a value of 15.57 ± 7.55, for Tau+ it was 11.32 ± 1.92 and the total value was 26.90 ± 8.95. For control the values of Tau- counts was 24.97 ± 10.28, for Tau+ it was 6.79 ± 4.14, the total value was 31.77 ± 9.24.
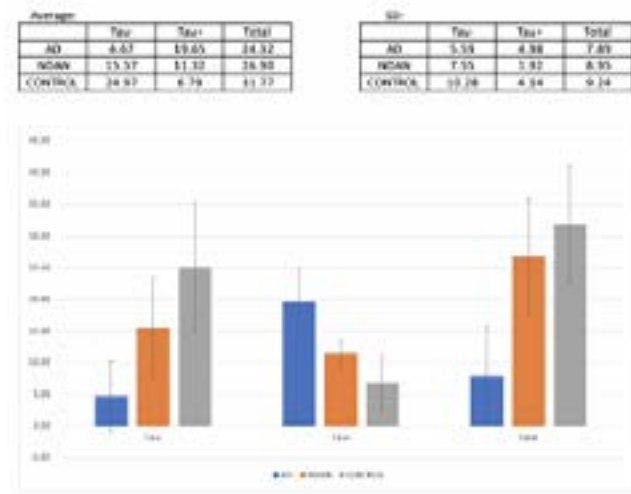
Figure 1: CA1 Tau Counts

Differences in Cell Size

The measurements of the ten most prominent healthy (Tau -) neurons taken demonstrated that the largest neurons were contained in the NDAN individuals, the second largest overall was presented by the AD individuals and lastly the control individuals had the smallest (Tau-) measurements overall. For the cell measurements the mean size for neurons measured in AD was 14.72 ± 2.75 µm. NDAN neurons had a mean size of 17.03 ± 1.79 µm. The control group mean neurons size was 13.36 ± 1.35 µm.
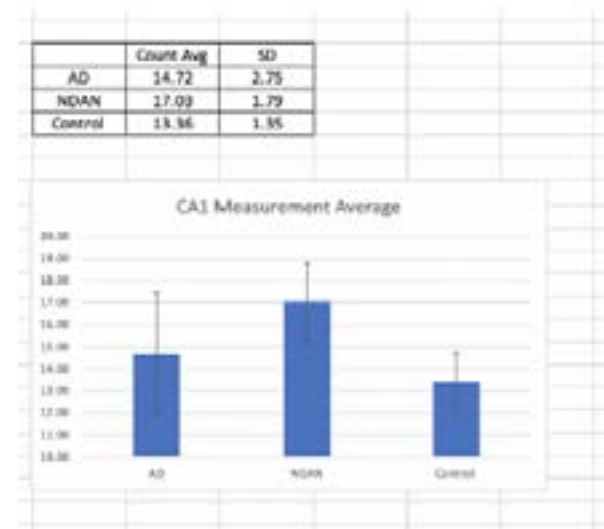
Figure 2: CA1 (Tau -) Neuron Measurement Average

Discussion:

We observed that the AD cases had the highest number of Tau+ neurons compared to NDAN and controls. AD cases also had the lowest mean numbers of healthy Tau- neurons and total neurons per sampling area compared with NDAN and control cases. It is assumed that the high number of Tau+ neurons in AD cases resulted in the significant neuronal loss in CA1 which eventually led to a significant shrinkage of the entire CA1 laminae. The most important observation was the presence of a large number of presumed healthy Tau- neurons present alongside numerous AD afflicted Tau+ neurons in the CA1 region of the NDAN cases. Since the Even though the NDAN cases expressed a high level of AD histopathology, the presence of large numbers of healthy Tau- neurons could be the reason that NDAN individuals did not suffer from dementia.

When we measured the mean cross-sectional diameters of the surviving healthy Tau- neurons the mean size of the Tau- CA1 neurons in AD and NDAN cases was larger than the Tau- CA1 neurons in the normal control cases. We hypothesize that Tau- CA1 neurons in AD and NDAN cases were larger than the neurons in control because the neurons that were able to survive the neurotoxic effects of Tau, were also able to not only maintain their original size, but were able to grow in size (undergo hypertrophy) in response to extending their axons into neighboring areas vacated by degenerating Tau+ neurons. Reactive synaptic rearrangement and synaptogenesis is a common phenomenon that has been described in a number of brain areas. A measurement of all the healthy (Tau-) neurons contained in each slide might have provided a better representation of all neurons, compared to the measurement we conducted of the ten largest ones, but the addition of measuring large numbers of potential Tau- degenerating/shrinking neurons would have diluted the effect for the detection of neuronal hypertrophy. The hypertrophy of the healthy neurons in NDAN (and AD) may have taken over the functions vacated by the degenerating neurons; they might have also taken up synaptic space and formed more connections and because of the added connections might have grown larger.

Conclusion:

It is widely believed that AD histopathology is accompanied by a loss of functional neurotransmission and hypometabolism with resulting development of cognitive loss or dementia. Along with the previous statement, it is believed that the neurovascular damage caused by AD related proteins Aß and MAP tau are made possible by a variety of AD related genes such as PSEN1, PSEN2, APOE4, APP, ultimately resulting in neuronal loss due to damaged blood vessels, reduced blood flow and/or hypoxia. Our work is consistent to observations by Vivianne Mitri (2020) who demonstrated that healthy neurons in non-demented AD (NDAN) cases expressed elevated levels of hypoxia inducing factor 2a (HIF-2a) in CA1 and the subiculum. Our work is also consistent with several reports of the benefits of hypoxia adaptation to surviving neurons and the prevention of reduction of cognitive deficits followed by the neuroprotective effects of prior exposure to ministrokes. The present study demonstrates that many neurons can survive and even thrive against the neurodegenerative effects of AD histopathology. The present study also reveals the possibility that we might be able to do something to prevent dementia, even if we are unable to stop AD histopathology. We propose that mental exercise naturally induces "functional" hypoxia which could then stimulate alternative metabolic pathways which these neurons can readily use to protect themselves from the neurotoxic effects of Tau or Amyloid plaques, so by this logic engaging in continual mental activities can increase the probability of neuron survival. While most past research funding has been devoted to AD research by eliminating or suppressing the effects of Aß or amyloid plaque formation, or the progression of tau pathology, very little funding has been devoted to preventing dementia by the promotion of neuronal survival. This needs to change.

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Halabi Noor*   **Development and Characterization of an Aspirin Transdermal Drug Delivery Patch**

Dr. Laila Jallo

Abstract

Transdermal drug delivery is proposed to be a viable delivery method for a drug, Aspirin, which is traditionally administered through the oral route. The Transdermal drug delivery method will bypass the Gastrointestinal (GI) tract thus limiting the ulcers and bleeding which occurs in many patients who chronically take Aspirin. In addition to internal bleeding, the oral route for aspirin shows lower bioavailability of the drug, which indicates that for certain individuals, the harm of administering aspirin orally far outweighs the benefits. Transdermal delivery of Aspirin faces obstacles imposed by the hydrophobic character of Acetylsalicylic acid (Aspirin). For efficient delivery of Aspirin, the active pharmaceutical ingredient (API) needs to be suspended within a blood-soluble aqueous phase. The lipophilic affinity and low solubility of Aspirin in deionized water would require a large volume delivery device to ensure full dissolution of the drug in the aqueous phase. The proposed drug delivery vehicle consists of a water in oil emulsion that is gelled into a stable emulgel that can be applied to the skin. However, to account for the hydrophobicity of the drug molecule, the aqueous phase was altered through the addition of ethanol. Addition of ethanol would increase the solubility of Aspirin into the aqeous phase and would act as a chemical penetration enhancer. The volume of the aqueous phase and the ideal volumetric fraction of the water is determined by rheological characterization of the formulated drug delivery vehicle. The characterization included viscosity measurements acquired by a viscometer, separation studies, and hydrophobicity testing accomplished using a tensiometer. It was determined that a 4mL aqueous phase composition of 80% water and 20% ethanol showed the highest stability and was the most promising overall as a base for the water-in-oil emulgel based transdermal drug delivery device. Moreover, a prototype of a Franz diffusion cell was roughly prototyped through SOLIDWORKS with the goal of conducting future diffusion studies once the drug delivery device is fully formulated.

Introduction

Since their invention, pharmaceuticals are known to have significantly impacted humans' quality of life. Much of the increase in life expectancy can be attributed to medication and other pharmaceuticals that have achieved breakthroughs in treating illnesses with high mortality rates. Pharmaceutical chemists are constantly working to discover new drugs that would efficiently treat acute or chronic illnesses. The extensive effort placed into discovering new drugs is complimented with the work of engineers who aim to provide an efficient and economic method to deliver the drug to the intended host cells and tissues. Methods of drug delivery remained largely the same despite the constant innovation in the field of drug synthesis [1]. The most common types of drug delivery have included pills, hypodermic needles, as well as topical medical. However, drugs have become increasingly more complex. With this complexity comes the consideration of side reactions and concerns of bioavailability of the drug should the engineers opt into using

traditional methods of drug delivery [1]. These concerns have pushed for the exploration and assessment of a variety of new drug delivery methods that would ensure a safe delivery of the drug to its target without any sacrifices in its effectiveness [1]. This is traditionally done by observing the transport behavior of the drug, its potential reactions, as well as its metabolism in the body. One prominent drug which is extremely susceptible to a decrease in effectiveness due to an inefficient route of delivery is the non-steroidal anti-inflammatory drug, Acetylsalicylic acid, commonly known as Aspirin. This drug is very commonly used in American households and recently, in October of 2021, the American Heart Association advised doctors against the prescription of this drug as means of lowering heart disease risk [2]. This is due to the fact that the risk of gastro-intestinal bleeding posed by the regular intake of the drug far outweighs its benefit in reducing the risk of a heart attack [2]. The reactions responsible for the increased risk of bleeding due to regular administration of Aspirin play a key role in the overall decrease in the drug's effectiveness, despite its various benefits. Therefore, it is hypothesized that an alteration in the method of drug delivery of Aspirin would be crucial in the endeavor of increasing the drug's effectiveness. The most important factors in determining the appropriate mode of drug administration are effectiveness and bioavailability [3]. The effectiveness of a drug delivery mechanism is directly related to inciting the desired immune responses and avoiding any side reactions that might affect the function of the drug itself [3]. Bioavailability, on the other hand, addresses the extent upon which the intended biological systems can absorb and readily utilize the administered dose of a drug [4]. Examination of different methods of drug delivery, as discussed in the background, has led to the preliminary hypothesis that a transdermal drug delivery patch might be the most viable administration method for Acetylsalicylic acid. This hypothesis is to be tested through the creation and rheological characterization of emulgel based patches in an effort to proof the commercial viability of the end product. The emulgel consists of a gelled water-in-oil emulsion which was created by using Medium Chain Triglyceride (MCT) oil for the lipophilic phase and a mixture of deionized water and ethanol for the aqueous phase. Formulated emulsions were subjected to separation studies where the height of the separated phase was recorded over a period of time. Next the viscosity of emulsions with aqueous phases varying from 50 vol% ethanol/50 vol% water to 20 vol% ethanol/80 vol% water (incremental increase of 10 vol% water) were acquired using a Brookfield DV2T viscometer. Identifying the ideal composition of the aqueous phase gave way to testing the ideal weight fraction of sodium alginate needed to gel the emulsion. The amount of sodium alginate required to gel the emulsions was determined qualitatively. The gels were then subjected to contact angle testing using a Kruss K-100 Force Tensiometer to get a rough estimation of the hydrophobicity of patches with slightly varying thicknesses.

Background

Acetylsalicylic acid (ASA) is the main ingredient in an Aspirin formulation. This non-steroidal anti-inflammatory drug (NSAID) is usually administered for its analgesic effects. Aspirin provides anti-platelet effects which allowed the extension of its use to include the treatment of cardiovascular disease. This effect of aspirin is also desirable in the prevention of other ailments such as cancer and pre-eclampsia [5]. Nonetheless, despite the obvious benefits of the drug, a correlation has been established between regular intake of aspirin and gastrointestinal bleeding [5]. The mechanism through which this bleeding is established has remained largely ambiguous; however, it has been concluded that the primary cause of

bleeding is the back diffusion of hydrogen ions into the gastric barrier [6]. In other words, the metabolic route of aspirin has led to a decrease in the pH and thus to irritation of the gastric lining. The anti-platelet effect of aspirin worsens the injuries sustained due to inhibition of the enzyme cyclooxygenase [7]. This inhibition is crucial for effective aspirin administration as it impedes the formation of prostaglandins, which are molecules responsible for inflammation and fever [7]. However, prostaglandins also play a key role in cytoprotecting the stomach lining through platelet aggregation [7]. Without proper blood coagulation the bleeding in the GI tract is exacerbated and can lead to complications such as infections, shock, and death [8]. Regardless of the mechanism through which aspirin directly leads to the increased bleeding, it has been determined that it is the metabolism of aspirin into salicylic acid which is solely responsible for the lowered pH in the GI tract. The following figure demonstrates the route taken by aspirin to metabolize.
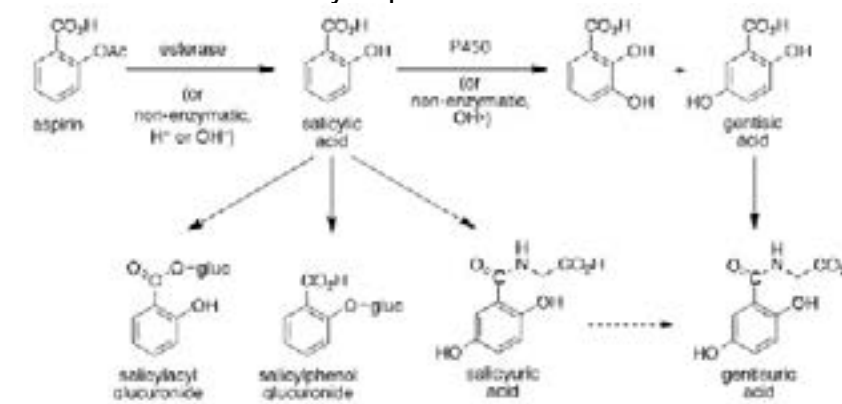
Figure 1: Metabolism of Aspirin [9]

Since esterase is an enzyme primarily extant in the GI tract, then it can be deduced that this metabolic route of aspirin, which occurs when the drug is taken orally, contributes to the overall decrease in the bioavailability of the drug. There exist various reasons which can be attributed to how the oral drug delivery route has proven itself to be very attractive. First, oral drug delivery is relatively painless and easy which increases patient compliance compared to other routes, such as the intramuscular injection [10]. Moreover, advancements in oral drug delivery have made this option even more advantageous through ratecontrolled drug coating which ensure sustainability of administered dosages [10]. Finally, manufacturing of drugs intended for oral delivery is more economically feasible to both the manufacturer as well as the consumer. The economic feasibility of oral drug administration can be attributed to the fact that the solid formations containing the active pharmaceutical ingredients tend to possess a prolonged shelf life [10]. However, as aforementioned, the complications that accompany oral delivery route can lead to the futility of the drug as it might cause more harm than benefit. In order to neutralize the disadvantages of an otherwise useful drug, it is crucial to understand the biochemical processes which aspirin undergoes in the GI tract. Having this knowledge aides in isolating the mechanism responsible for the gastrointestinal bleeding. This would then motivate the research surrounding the evasion of unwanted side reactions. Once aspirin is consumed, it will pass through the GI tract where it will undergo hydrolysis [11]. During hydrolysis the ester functional group, found on ASA, will be cleaved and the molecule would be converted to a metabolite of ASA called salicylic acid (SA) [11]. Salicylic acid is agastrointestinal irritant that contributes to the frequent bleeding experienced by chronic

would be converted to a metabolite of ASA called salicylic acid (SA) [11]. Salicylic acid is a gastrointestinal irritant that contributes to the frequent bleeding experienced by chronic users of aspirin [11]. The enzyme primarily responsible for converting ASA into SA is esterase which is usually found in the stomach lining and the liver [12]. Therefore, in an effort to avoid premature metabolism, the drug should be administered in a manner that bypasses the gastrointestinal tract. This would not only contribute to eliminating the risk of GI bleeding but would also increase the bioavailability of the drug by preventing its first pass metabolism in the stomach.

In an effort to efficiently bypass the GI tract, this research aims at the creation and assessment of a transdermal drug delivery patch loaded with Aspirin as the Active Pharmaceutical Ingredient (API). Transdermal drug delivery consists of bypassing the GI tract by delivering the API through the skin and directly into the bloodstream. Other drug delivery methods, like intramuscular needles (IM), also have the potential of delivering the drug into the bloodstream. An IM needle will deliver the drug directly into the vascular muscles which will greatly increase bioavailability as the drug would be readily taken up by the existing veins [13]. However, there are disadvantages to IM needles that need to be considered. First, absorption of the drug depends on the bulk muscle and cannot be controlled [13]. Ideally, the drug delivery system should be continuously releasing aspirin in its most chemically stable form [14]. However, the IM administration of this drug would impede any chance of having a rate-controlled diffusion and would thus make the pharmacokinetics of the drug very unstable. Moreover, IM administration requires the presence of a professional and might decrease patient compliance due to needle anxiety [13]. These key factors contribute to the proposal of a transdermal patch as a viable alternative to orally administered Acetyl salicylic acid (ASA).

The transdermal drug delivery patch will overcome the challenges posed by using other methods such as oral administration or IM needles. First, transdermal drug delivery is non-invasive and would not pose any risk of triggering fears associated with IM needles, such as wrongful administration. Moreover, the pharmacokinetics of transdermal drug delivery tends to be less ecstatic and effectively reduces the risk of overdose due to wrongful administration. The pharmacokinetics of transdermal delivery tend to also be less complicated by virtue of the fact that drug does not require passage through the liver. By passing directly to the blood, transdermal drug delivery can show a tremendous increase in drug bioavailability.

Usually, a transdermal patch is constructed as a reservoir device with four primary layers; a backing, a reservoir where the drug is stored, a rate controlling membrane, and an adhesive [15]. However, for purposes of simplicity, the aspirin transdermal patch will adopt the "adhesive device" design. This design consists of two layers: an impermeable backing and a drug containing adhesive. In addition to simplicity this design would decrease the overall large cost that is associated with designing a transdermal patch [16]. The research aims at creating a transdermal drug delivery system while considering the structure of the human skin and its distinctive layers. The epidermis is made up of two layers the stratum corneum and the viable epidermis [16]. The surface of the epidermis consists of dead skin cells since keratinocytes mature and self-destruct in the stratum corneum [17]. This layer constitutes the body's first line of defense against the external environment and serves to keep and other materials away from the pores; thus, preventing entry into the human host [17]. The rate of mass transport is limited by the presence of this layer and its permeability. In fact, one of the focuses of this research will be to test the permeability of the skin by measuring

the rate of diffusion of aspirin through this layer and into the blood of the host. Transdermal drug delivery is accomplished through one of two routes, the intracellular route or the appendageal route. The intracellular route indicates that the drug passes through the stratum corneum [16]. However, this method is particularly difficult due to the fact that the stratum corneum consists mainly of keratins that are not soluble [17]. On the other hand, when the drug undertakes the appendageal route it will pass through the hair follicles and sebaceous glands [17]. The mode in which the drug will pass through the skin and into the blood stream depends mainly on properties of the drug itself [17]. Some of these characteristics include the drug's molecular size, acid dissociation constant, and nature of the bonds [16].

The framework previously laid out proposes the creation of a hydrogel-based adhesive. However, this choice overlooks the slight hydrophobicity of aspirin due to the presence of a benzene ring in its molecular structure [18]. The incomplete solubility of aspirin in water would require the formulation of a patch with a very large aqueous phase to dissolve the required dosage of 81 mg. This dosage is referred to as a "baby aspirin" and is frequently prescribed to patients who chronically use this medication [19]. Moreover, the creation of the hydrogel-based adhesive would render the patch hydrophilic and thus not commercially viable.

Therefore, the drug delivery device will consist of a water in oil emulsion. An emulsion consists of two immiscible liquids suspended in one another [20]. The bulk of the emulsion is called the continuous phase while the suspended droplets are referred to as the dispersed phase. Most emulsions can be classified as oil in water or water in oil emulsions [20]. The composition of an emulsion relies heavily on the desired properties. For the purposes of synthesizing a transdermal drug delivery patch, the research will mainly focus on creating a water in oil emulsion. This is due to hydrophobicity being the main factor in assessing the viability of the patch. The aspirin will be dissolved in an aqueous phase and suspended into the lipophilic phase.

Nonetheless, the mathematical framework for the diffusion of the API through the skin will remain the same and is essentially a mass transport problem that can be solved for diffusion across the stratum corneum to the viable epidermis and then to the blood.

Materials and Methods

Materials

Table 1: Material used in the formulation of emulgel (Amount used correlates to 80-20 emulsions)

Material	Amount used	Functionality	Company acquired from
Deionized water	8.8 mL	Main component of aqueous (aq) phase	CPP LAB, USA
Ethanol	2.2 mL	Secondary component of aq phase	Fisher Scientific, USA
Tween 80	5 g	Surfactant	Sigma Aldrich, USA
Medium Chain Triglyceride oil	10 g	Lipophilic phase	Medlab Supply, USA

Ascorbic Acid	0.11 g	Model drug for Aspirin	Medlab Supply, USA
Sodium Alginate (Manucol)	0.165 g	Gelling agent	FMC BioPolymer, USA
5 wt% Calcium Chloride solution	Spray to coat petri dish	Crosslinker	Sigma Aldrich, USA

Table 2: Equipment used for emulsion/emulgel testing

Equipment	Duration of use	Function
Cole-Parmer Digital Reversing Mixer System	40 mins	Mixing the emulsion to uniformly distribute the dispersed phased within the continuous phase.
Bamix hand mixer	3 mins	Further mix the emulsion to ensure smaller droplet sizes.
Brookfield DV2T Viscometer	10 mins / test	Viscosity measurements
Kruss K-100 Force Tensiometer	Until automated test was complete	Contact angle measurements

Methods

The work in this research extends from previous studies conducted on water in oil (W/O) emulsions. The study concluded that a W/O emulsion with Medium Chain Triglycerides (MCT) as the lipophilic phase presented as the most promising option in terms of longevity. The procedure recommended the use of 10 g of the oil phase, 11 g of aqueous phase, and 5 g of surfactant [20]. The volumetric percentages of water in the aqueous phase ranged from 50 vol% to 90 vol%, in increments of 10 vol%, with a balance of ethanol.The surfactant used was tween 80. This will then stabilize the W/O emulsion and prevent interfacial tension from breaking the emulsion. In lieu of loading the aqueous phase with aspirin, ascorbic acid (Vitamin C) was used. This substitution is justified due to the similarities in the chemical structure of both substances and the wider commercial availability of ascorbic acid. As for the gelling agent, sodium alginate was utilized. Sodium Alginate is relatively inert and commonly used in the formulation of pharmaceuticals and in foods [21].

Emulsion Formulation:

Tween 80 was added to the Medium Chain Triglyceride oil and mixed for 15 minutes. In a separate beaker, water, ethanol and ascorbic acid were added simultaneously and mixed until the ascorbic acid was dissolved. The MCT oil/ Tween 80 mixture was stirred by the Core-Parmer digital reversing mixer system at 40 RPM while the aqueous phase was being added in dropwise using a dropper. After adding the aqueous phase into the tween 80/ MCT oil mixture, the emulsion was first mixed with a hand mixer at high speeds. The intense turbulence generated from the mixer created a high level of shearing which better disperses the mixture and helps in decreasing the average size of droplets in the emulsion. Once this is completed, the emulsion is mixed using an electric mixer at 3 different speeds, 250, 300, and 350 RPM.

Separation Studies:

Emulsions were prepared with various aqueous phase compositions, as previously specified. The emulsions were stored in a drawer at room temperature (approximately 25 C). Initial height of the emulsion was acquired using a ruler on the day the emulsions were formulated. Over a period of three weeks, the height of separated phase was measured weekly, and the percent separation was calculated.

Viscosity Measurements:

Once the mixing process was complete the viscosity of the emulsions was measured using the DV2T viscometer. A sample of the emulsion was transferred into a test tube and an LV-03 spindle was used to acquire viscosity measurements over the course of 10 minutes. The procedure was repeated over three days.

Emulgel Formulation:

Once the ideal composition was isolated, the emulgels were formulated through the addition of Sodium Alginate into the aqueous phase. A petri dish was washed with DI water and isopropyl alcohol (IPA) then a Calcium Chloride (CaCl2) solution was sprayed onto a petri dish. The emulgel was then placed onto petri dish and was sprayed with CaCl2 again. Next, the petridish was sealed with parafilm and a lid. .

Contact Angle Measurement:

Next the hydrophobicity of the emulgel was tested through the use of the dynamic contact angle test in the Kruss K-100 Force Tensiometer. A rectangular piece of the emulgel was excised and an Alligator clip was used to suspend the emulgel over the testing solution (DI water).

Franz diffusion cell design:

Eventually, the diffusion of the emulgel across the skin will be simulated with the use of a Franz diffusion cell. A prototype of the Franz diffusion cell was constructed using SOLIDWORKS and the dimensions were chosen based on a diagram provided by the company PermeGear. This company professionally creates Franz diffusion cells and has the following specifications for a 9mm Flat Ground Joint Franz diffusion cell.

Table 3: Dimensions of Franz diffusion cell as outlined by PermeGear.

Joint Inner Diameter, mm	9
Joint Outer Diameter, mm	25

Receptor Volume, mL	5
Orifice Area, cm^2	0.64
Water Jacket Diameter, mm	30

The Franz diffusion cell will then be 3D printed at the Cal Poly Pomona Innovation lab using poly lactic acid filament.

In order for proper use of the Franz diffusion cell to occur, the receptor chamber needs to contain a liquid that can mimic the conditions of the human body. Phosphate buffered saline solution is suggested and will be prepared according to industry specifications documented by AAT Bio quest. The solution will be prepared by adding 8g of NaCl, 200 mg of KCl, 1.44 g of Na2HPO4, and 245 mg of KH2PO4 to 800 mL of distilled water [22] . This solution is to be kept inside the receptor chamber at a temperature of 37 degrees Celsius which will be done with the use of a water manifold that will continuously circulate heated water throughout the jacket of the cell.

Once the setup is complete, a synthetic "skin" obtained from 3M company will be placed into the membrane compartment and the emulgel will be inserted into the donor chamber. The emulgel will diffuse through the skin and into the PBS solution.

To track the rate of diffusion some of the PBS will be extracted through the sampling port at different intervals of time. Values for the concentration of ascorbic acid in the PBS solution will be determined using a refractometer.

Results and Discussion

The research project centered around refining the procedure for creating a transdermal drug delivery device. The procedure for formulating the water in oil emulsions was discussed in the methodology section. As aforementioned, for each variation of the aqueous phase, three emulsions were prepared at different mixing speeds: 250, 300, and 350 RPM.

Figure 2. Water in oil Emulsions created with a 100% water aqueous phase
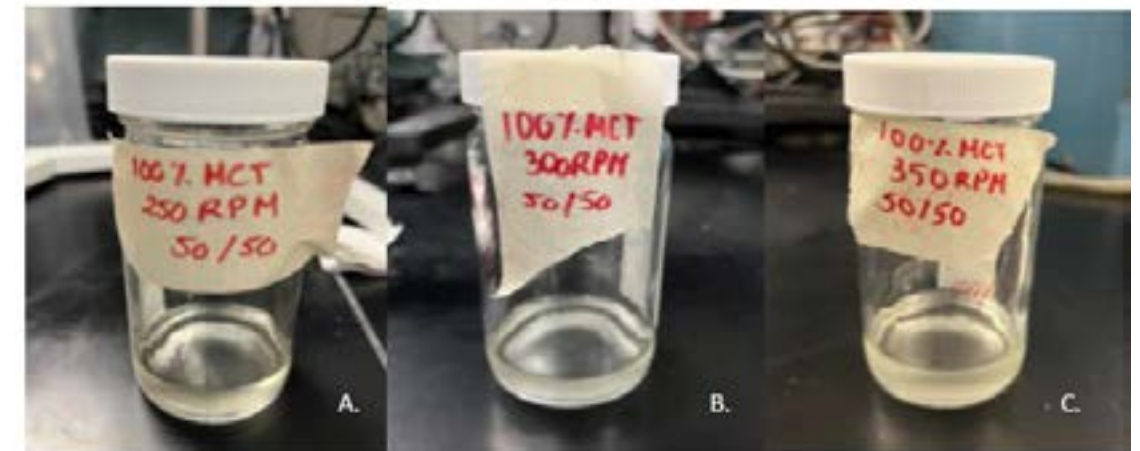
Figure 3. Water in oil Emulsions created with a 50% water 50% ethanol aqueous phase
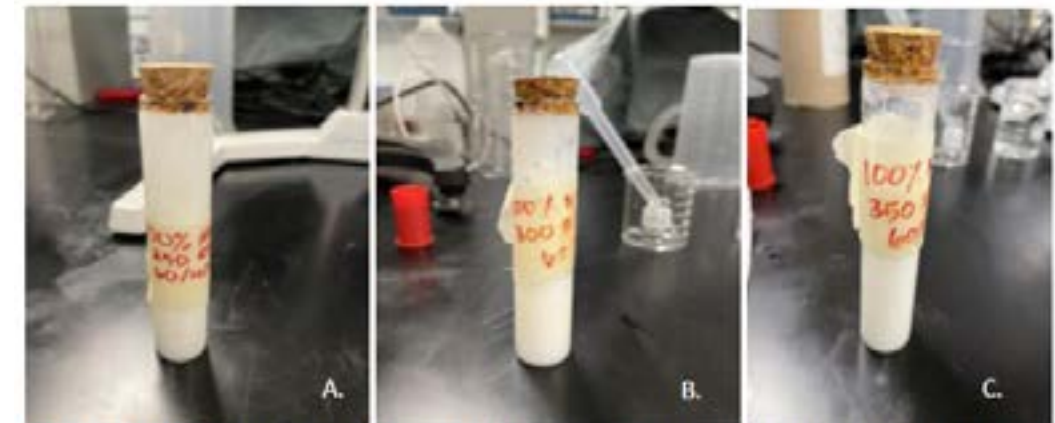
Figure 4. Water in oil Emulsions created with a 60% water 40% ethanol aqueous phase

The figures above display a small sample of the emulsions that were created for testing. All emulsions were formulated, and separation studies were conducted in the container displayed in figures 2 and 3. However, for viscosity measurements the emulsions were transferred to the tubes shown in figure 4in order to fit the viscometer's probe.

First separation studies were conducted, and the results are displayed graphically below. Separation data was acquired through the ratio of the separated height of the emulsion to the initial height of the emulsions according to the following formula.

$$\%Separation = \frac{height\ of\ separated\ phase\ (top\ phase)}{initial\ height\ of\ the\ emulsion} \cdot 100 \quad Eq.1$$

The height of the separated phase was monitored over a certain amount of time and the results were graphed accordingly. It is important to note that the procedure for emulsions formulated with 50 vol% water and 50 vol% ethanol deviated from standard procedure, due to high instability and rapid separation. The emulsions were fully separated within hours after formulation and the procedure monitored the separation over the course of 3 hours.
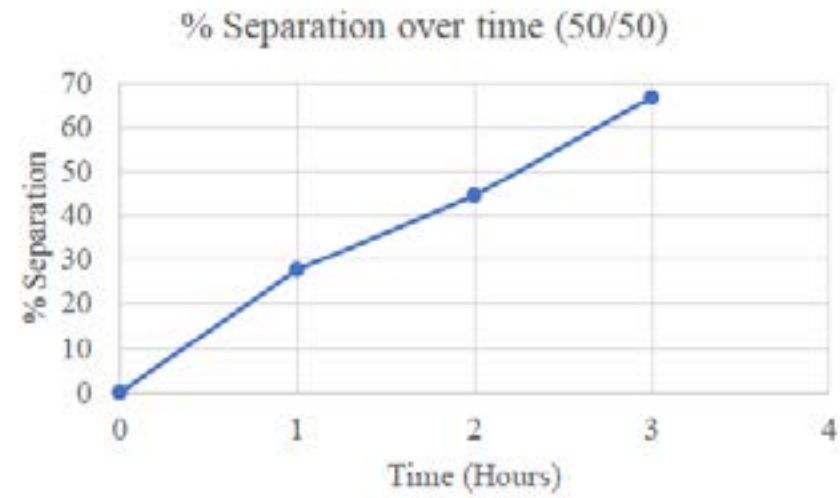
Figure 5. Separation over time graph for an emulsion prepared with a 50 vol% water and 50 vol % ethanol aqueous phase

Figure 6. Separation over time graph for an emulsion prepared with a 60 vol% water and 40 vol % ethanol aqueous phase
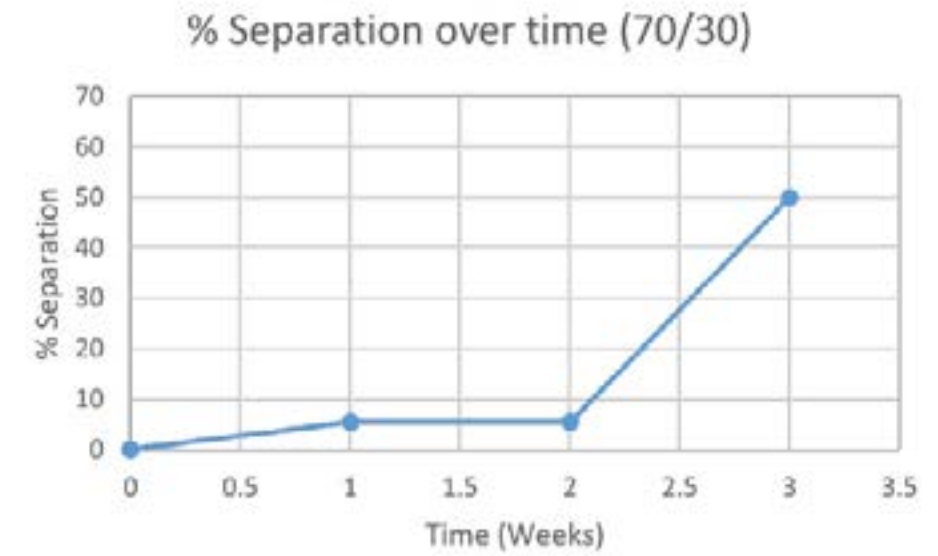
Figure 7. Separation over time graph for an emulsion prepared with a 70 vol% water and 30 vol % ethanol aqueous phase
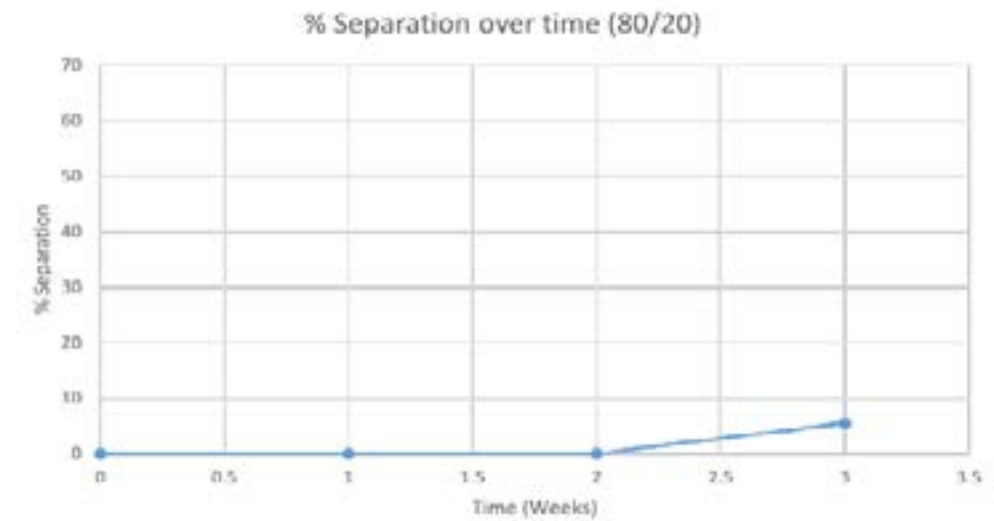
Figure 8. Separation over time graph for an emulsion prepared with a 80 vol% water and 20 vol % ethanol aqueous phase
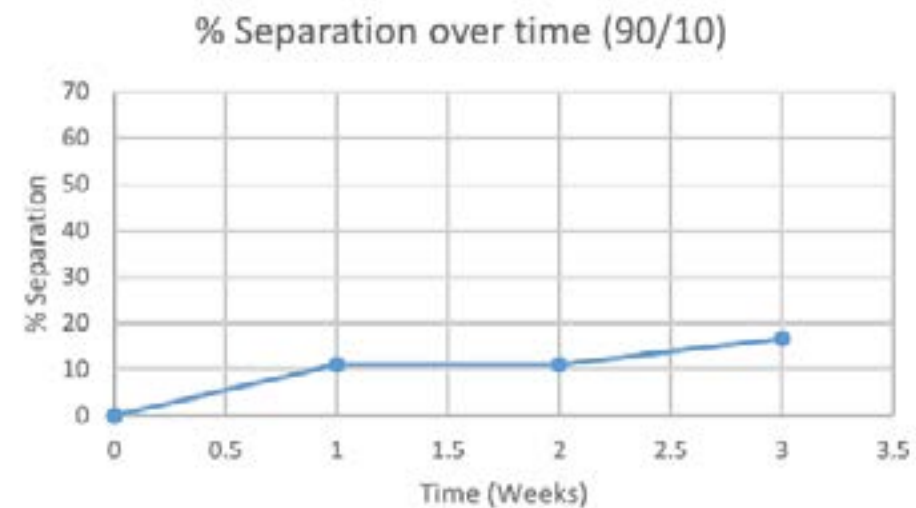
Figure 9. Separation over time graph for an emulsion prepared with a 90 vol% water and 10 vol % ethanol aqueous phase

The graphs displayed in figures 6 through 10are a representation of the percent separation observed in emulsions prepared for the formulation of the transdermal drug delivery patch. The graphs showed that the most drastic separation occurred between the second and third week after formulation of the emulsions. Stability of emulsion relies upon a delicate balance of forces acting on the interface of the emulsion. Instability leads to cohesive forces between droplets of the dispersed phase overpowering the presence of an emulsifier and consequently leading to visible separation when the drops start floating to the surface [24]. In addition to the Van der Waals forces present in the bulk phase (Medium Chain Triglyceride oil) and the hydrogen bonding occurring in the dispersed phase (water and ethanol) there are slight electrostatic repulsion forces acting on the emulsion as a result of the polarity of MCT oil [25]. These forces would contribute to the instability of the emulsion as oil polarity has been correlated to a decrease in emulsion stability [24].

It is noted that decreasing the amount of ethanol introduced into the aqueous phase contributed to less % separation and in turn to higher stability. The 50-50 emulsions completely separated only hours after their creation where two phases could be seen. The high concentration of the nonpolar carbon chain in ethanol lead to repulsion of ethanol from the aqueous phase and thus to the formation of a highly unstable emulsion. Lowering the volumetric percent led to less noticeable separation until a significant amount of time has passed (days to weeks).

Despite issues of instability, the addition of ethanol to the aqueous phase in this reaction was considered for two main reasons. Ethanol is being investigated for its use as a chemical penetration enhancer. Ethanol was found to enhance bilayer permeability by enhancing the mobility of lipid chains [26]. Moreover, due to the presence of a benzene ring in the structure of Aspirin the molecule is rendered hydrophobic. This is further confirmed by the low solubility of Aspirin in water at 3.3mg/mL of water [27]. The drug is almost 24 times more soluble in Ethanol at 80

mg/mL [27]. Therefore, including ethanol plays a role in increasing the overall solubility of Aspirin in the aqueous phase which in turn would require a smaller volume of emulsion to create a transdermal drug delivery device loaded with the dosage of a baby Aspirin, 81 mg [28]. This would make the formulation of the device more economically feasible as well as increase convenience for the consumer in terms of placing a smaller patch to administer the required dosage.

Due to the benefits of including a small hydrocarbon into the aqueous phase of the emulsion, it is desirable to have the highest volumetric percentage of ethanol without sacrificing the integrity and stability of the emulsion. Observing the separation behavior of multiple emulsions over the course of several weeks has proved that any volumetric percentage greater than 20 vol% would severely affect the stability of the emulsion. Figure 8 clearly displays the separation trend for emulsions formulated with an 80% water and 20% ethanol aqueous phase. These emulsions showed negligible separation until the second week where they only separated approximately 5%.

Separation studies are not sufficient to deduce definitive conclusions about the stability of a particular set of emulsions. Therefore, the research extended to include viscosity studies for emulsions prepared with every composition.
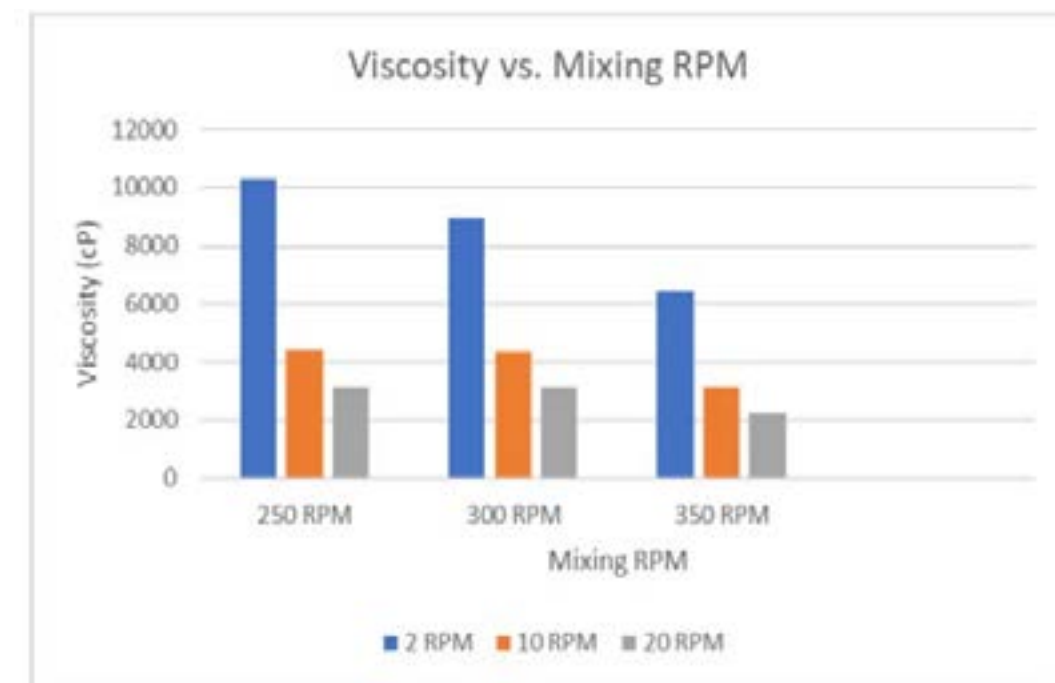
Figure 10. Viscosity of emulsions with 100% water aqueous phase

The viscosity of each emulsion was taken on the day they were created. Each bar represents the viscosity value at a specific spindle RPM, not to be confused with the mixing RPM. Spindle RPM correlates to different shear rates (torque %) applied to the emulsion, where higher RPM values indicate a greater shear. The viscometer measures viscosity by observing the resistance of the spindle to motion inside the fluid. The highest resistance is recorded at 2 RPM indicated by the high viscosity value. The slower the spindle RPM, the higher the full-scale range of viscosities

that can be detected by the viscometer. At 2 RPM the FSR is 60,000 cP; therefore, viscosities ranging from 5220 cP at 350 RPM to 10120 cP at 250 RPM are only a small fraction of the full scale range indicating that the torque % will be considerable low thus making the data less accurate. Therefore, it can be claimed with certainty that the viscosity measurements acquired at 10 or 20 RPM are a much better gauge of the true viscosity of the emulsion. At a spindle speed of 10 RPM, the viscosity of the emulsion prepared at 250 RPM was 4276 cP while that prepared at 300 RPM was 4305 cP and that prepared at 350 RPM was 3149 cP. Meanwhile at a speed of 20 RPM, the 250 RPM, 300 RPM, and 350 RPM emulsions exhibited the viscosities 3179, 3220, and 2240 cP, respectively. The torque percent value at 20 RPM was in 50- 60% range. The recommended torque % value is any value above 10% for a working volume of 500 mL. Due to the small working volume of the created emulsions (approximately 25 mL) then much higher torque values, as is the case in the 20 RPM spindle speed, would present a much better estimation of the true viscosity. Therefore, preliminary results showed that an aqueous phase of 100% DI water presents viscosities ranging roughly from 2000 cP to 3000 cP.

Figure 12. Viscosity of 300 RPM emulsion with 50% water – 50% ethanol aqueous phase

Figure 11. Viscosity of 250 RPM emulsion with 50% water – 50% ethanol aqueous phase
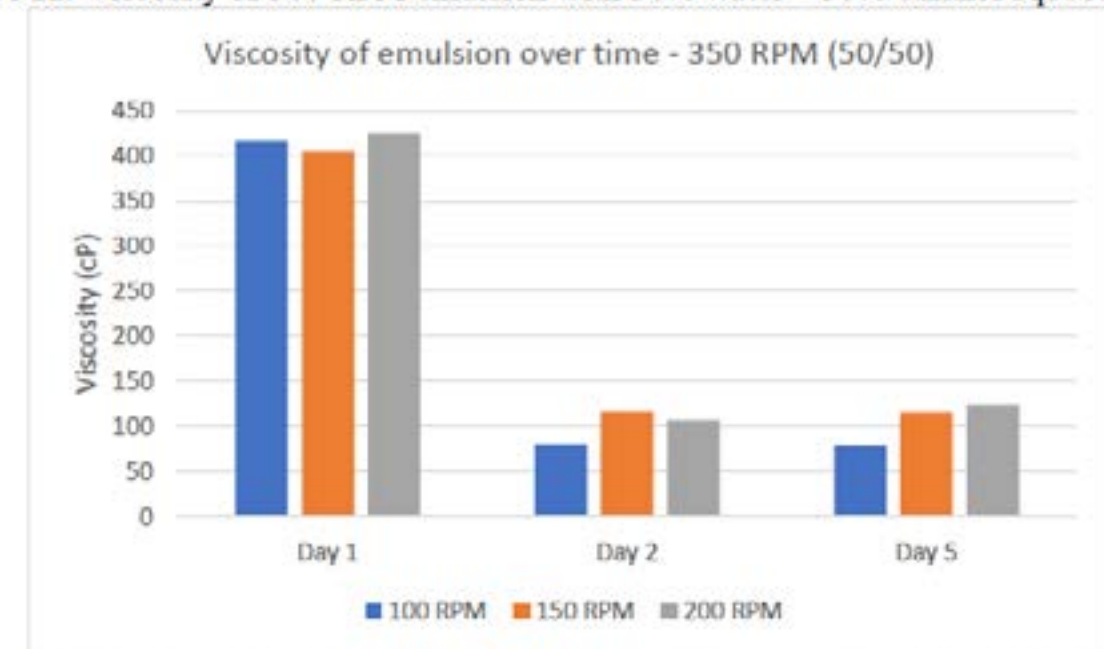
Figure 13. Viscosity of 350 RPM emulsion with 50% water – 50% ethanol aqueous phase

The viscosity of 50-50 emulsions remained constant at every spindle RPM implying the Newtonian behavior of the emulsion, where the viscosity is independent of applied shears. Despite each component being a Newtonian fluid, the emulsion is not expected to present Newtonian behavior due to the concept of droplet crowding. This ensures that the viscosity of the emulsion is substantially greater than that of either the lipophilic or aqueous phase of the emulsion. The viscosities presented above have all been acquired at torque percentages much greater than 10% to ensure reliability. Torque% ranged from 40%-70% for day 1, from 17-25% for day 2 and from 16-22% for day 3. The RPM values of the spindle were held constant however due to the decrease in emulsion viscosity from day to day, the value of the torque % decreased as well according to the following equation

$$\%\tau = \frac{\mu}{\mu_0} \qquad Eq.\,2$$

Where $\%\tau$ is the torque percentage, μ is the viscosity of the emulsion and μ_0 is the full-scale range of viscosity detected by the viscometer at a specific RPM with a specific spindle. On the day of formulation, the viscosities of the emulsions ranged from 235 cP to 348 cP when mixed at 250 RPM corresponding to spindle RPMs of 150 and 200 respectively. Within a 24-hour period the viscosities of the emulsions had dropped to 125 cP at a spindle RPM of 100 and to 134 at both 150 and 200 spindle RPM. A few days later the viscosity had decreased to 53 cP at all three spindle RPMs (100,150, and 200 RPM). The independence of the viscosity from applied shears is most obvious a few days after the formulation of the emulsion when they have completed almost entirely. At that point, the viscometer would only be detecting the viscosity of the less dense phase of the emulsion (top phase). Very similar trends were observed for emulsions prepared at a mixing RPM of 300 and 350 RPM indicating an independence of viscosity from the mixing RPM.

The next composition considered for the aqueous phase of the transdermal drug delivery device is 60% water and 40% ethanol. The viscosity data for this composition was acquired over a period of time and graphed below.

Figure 15. Viscosity over time of 60-40 emulsions prepared at 300 RPM mixing spee
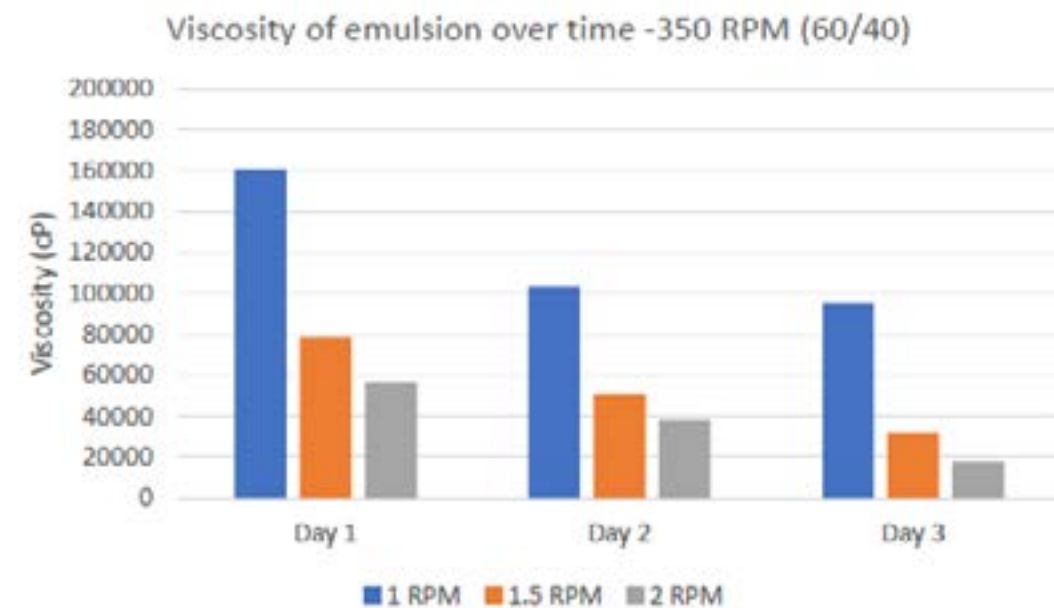
Figure 16. Viscosity over time of 60-40 emulsions prepared at 350 RPM mixing speed

Figure 14. Viscosity over time of 60-40 emulsions prepared at 250 RPM mixing speed

The viscosities of the 60-40 emulsions did present a slight non-Newtonian behavior where the viscosity of the emulsions appeared to be decreasing as a response to increased shear. This is known as shear thinning. The presence of this non-Newtonian behavior does imply the potential presence of droplet crowding. In this study, viscosity acts as a proxy to droplet size characterization. Smaller droplets tend to be more rigid as it is very difficult to further decrease the size of these droplets. This rigidity is responsible for the overall increase in viscosity compared to emulsions with larger droplet sizes [28]. The viscosities of these emulsions are very high with an order of magnitude between 104 to 105cP. At a spindle speed of 1RPM, the viscosity of the 60-40 emulsions decreased from an average of 98040 cP on the first day to 26400 cP on the third day for emulsions prepared at 250 RPM mixing speed. At the same spindle RPM, the viscosity of emulsions prepared at 300 RPM and 350 RPM decreased from 207,000 cP to 115,000 cP and 160800 cP to 95000cP respectively. Applying the highest shear to this emulsion at 2RPM, the viscosity of the 60-40 emulsions decreased from an average of 52740 cP on the first day to 17,460 cP on the third day for emulsions prepared at 250 RPM mixing speed. At the same spindle RPM, the viscosity of emulsions prepared at 300 RPM and 350 RPM decreased from 132,000 cP to 14,000 cP and 56640 cP to 17490 cP respectively. A sharper decrease in viscosity on each day with an increase in spindle RPM is indicative of a more definitive non-Newtonian behavior. On the first day, the percent difference between viscosities acquired at 1RPM and 2RPM was 44.35%, 60.09% and 95.46% for mixing RPMs of 250, 300 and 350 respectively. Meanwhile, on the third day the percent differences were 40.7661%, 156.56%, and 137.81% for mixing RPMs of 250, 300 and 350 respectively. This indicates that the non-Newtonian character was more prominent in emulsion prepared at 300 and 350 RPM. Nonetheless, all the emulsions prepared with a 60-40 aqueous phase composition separated up to 60% within the first three weeks of formulation thus implying significant issues of stability with accompanying the utilization of these emulsions for the formulation of the Aspirin transdermal drug delivery patch.

Next the viscosity of emulsions prepared with 70% water and 30% ethanol was considered. The viscosity data for this composition was acquired over a period of time and graphed below.

Figure 18. Viscosity over time of 70-30 emulsions prepared at 300 RPM mixing speed
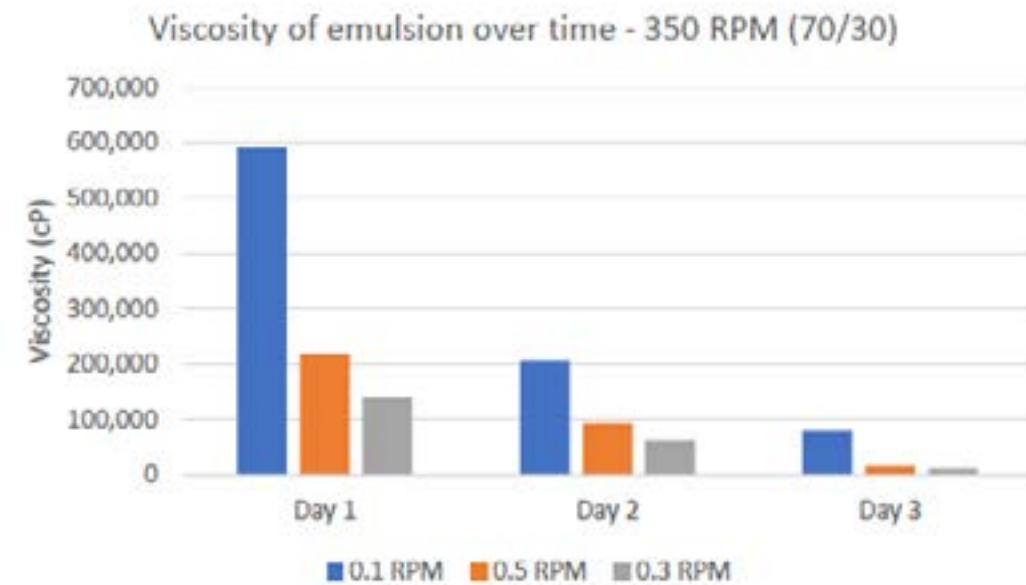
Figure 19. Viscosity over time of 70-30 emulsions prepared at 350 RPM mixing speed

Figure 17. Viscosity over time of 70-30 emulsions prepared at 250 RPM mixing speed

The viscosities of the 70-30 emulsions presented a trend similar to that of the 60-40 emulsions. A non-Newtonian behavior was observed with the change of viscosity as a response to a change in applied shear. Specifically, the viscosity decreased with an increase in applied shear indicating a shear thinning behavior. The presence of droplet crowding is more prominent in the emulsions prepared with a 70-30 aqueous phase since the difference in viscosity between the lowest (0.1 spindle RPM) and highest (0.3 spindle RPM) shear rate is 117.6%, 125.5%, and 124.12% at day 1 for mixing RPMs of 250, 300 and 350 respectively. At the final day, the % difference for each mixing RPM was 47.011%, 37.72%, and 148.5%. The percent difference of viscosity between the lowest and highest spindle RPM on the first day was considerably higher for 70-30 emulsions compared to the 60-40 emulsion; thus confirming the higher non-Newtonian character of the 70- 30 emulsions. This characteristic of emulsions prepared with a 70-30 aqueous phase would further implicate a higher probability for the presence of droplet crowding within the emulsion. Droplet crowding is characterized by the presence of a high concentration of small droplets that are responsible for the overall non-Newtonian behavior of the emulsion [29]. High concentrations of small droplets is a desirable feature in the emulsion upon which the transdermal drug delivery device will be based upon. This is primarily due to the nanosized pores present on the human skin, ranging from 250 to 500 nm [30]. Moreover, the viscosity of the emulsions prepared with a 70-30 aqueous phase was all in the 105 order of magnitude regardless of the amount of shear applied to it. The high viscosity of these emulsions further implies the presence of small droplet sizes which proves the 70-30 emulsions more desirable than the previous 60-40 emulsions.

However, one important feature concerning the 70-30 emulsions that cannot be overlooked is the decrease in viscosity at each shear rate with the passage of time. At the lowest spindle RPM the viscosity of emulsions decreased by 83.69%, 96.64%, and 86.81% between the first and third day for 250, 300, and 350 mixing RPMs respectively. Meanwhile, the viscosity of 60-40 emulsions decreased by 73.08%, 44.44%, and 40.92% between the first and third day for 250, 300, and 350 mixing RPMs respectively. Despite the spindle RPM varying for either emulsions the data is comparable due to the torque percent decreasing from 40-50% range at day 1 to 15-30% range for day 3 in either case. It is obvious that the percent decrease in emulsions prepared with 70-30 aqeous phases is much more dramatic that that observed in the 60-40 emulsions. This is most likely due to the presence of flocculation. Floccs occur due to the aqueous phase entrapping some of the continuous phase within it. In other words, due to the higher fraction of water in the 70-30 emulsions, the ethanol attracted some of the MCT oil continuous phase and encapsulated it creating some sort of oil in water in oil (O/W/O) emulsion. This flocculation are highly unstable, especially in the presence of a hydrophilic surfactant such as tween 80 which leads to the drastic decrease in viscosity over time. Moreover, the 70-30 emulsions experienced up to 50% separation within the first three weeks of formulation; therefore, aqueous phases with lower volumetric fraction of ethanol were prepared.

Next, the viscosity of emulsions prepared with 80% water and 20% ethanol was considered. The viscosity data for this composition was acquired over a period of time and graphed below.
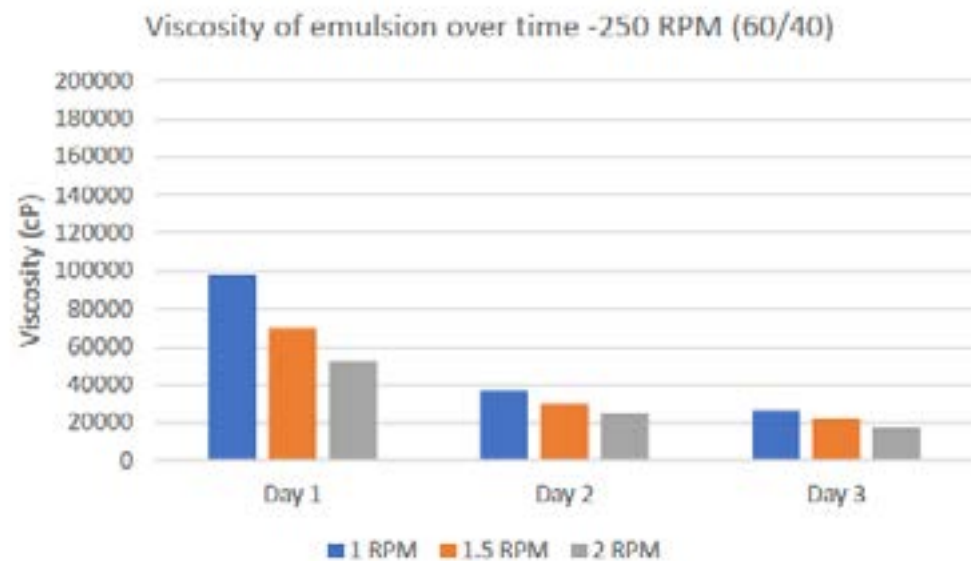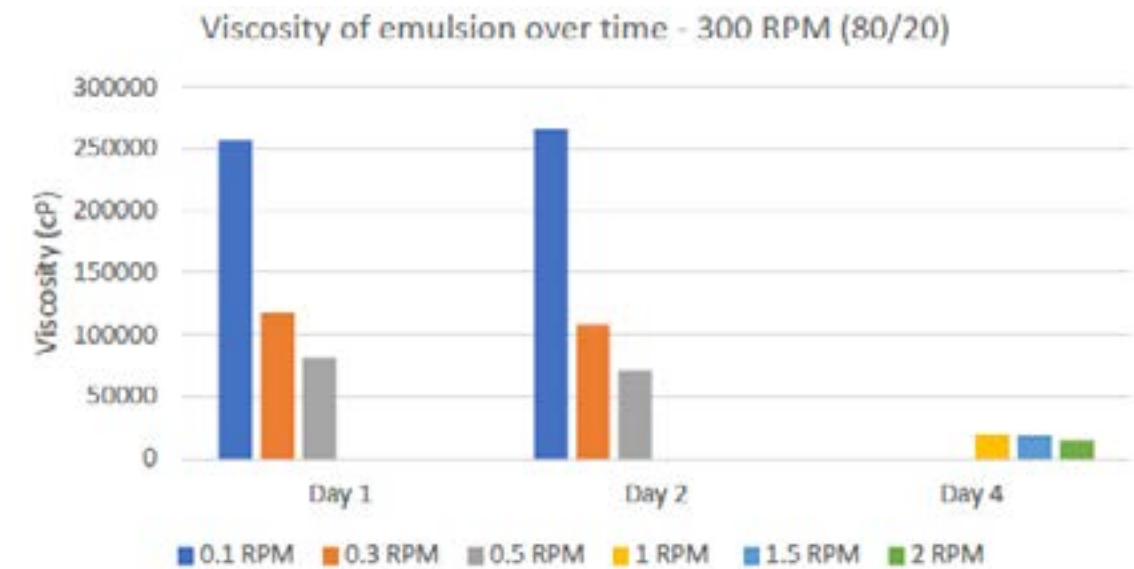

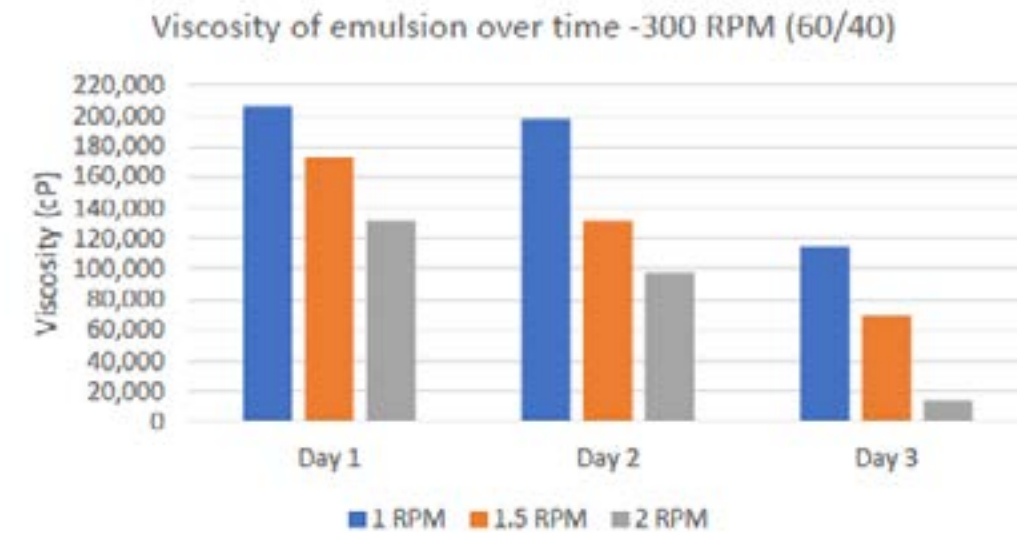Figure 20. Viscosity over time of 80-20 emulsions prepared at 300 RPM mixing speed
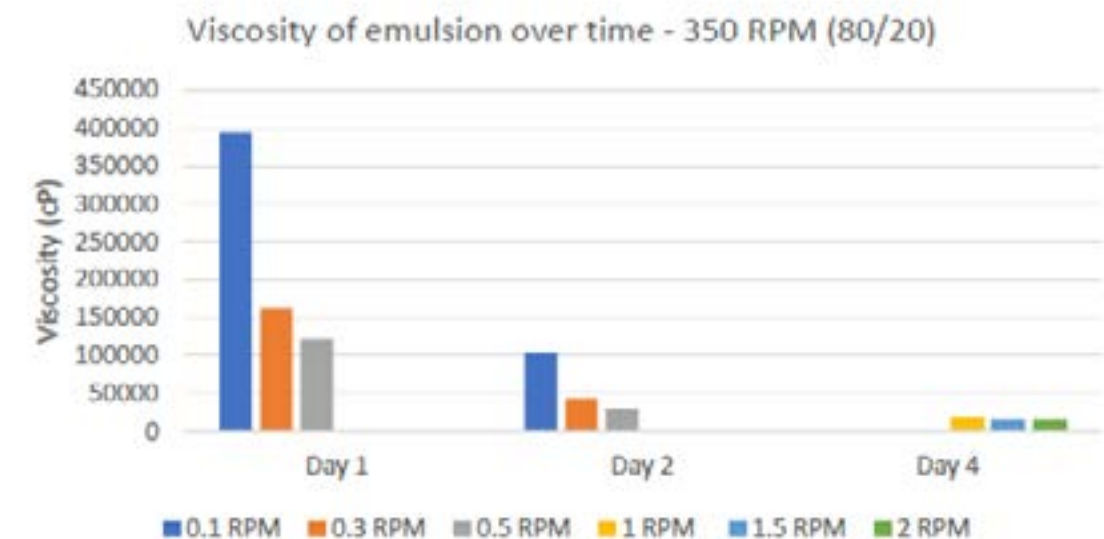
Figure 21. Viscosity over time of 80-20 emulsions prepared at 350 RPM mixing speed

As aforementioned, emulsions prepared with an 80% water and 20% ethanol aqueous phase proved to be the most stable in terms of separation studies. However, other features made these emulsions desirable as well. The viscosity measurements for the 80-20 emulsions were in the 105 orders of magnitude confirming the presence of a high concentration of small droplets within the emulsion. As time progressed, the emulsions broke due to coalescence of aqueous phase droplets, thus creating larger droplets within the emulsions and effectively decreasing the viscosity of each emulsion. It is more desirable for the emulsion to break through coalesce than due to the formation of flocculation. This is due to the hydrophilic nature of the human blood where the presence of oil droplets within the drug loaded phase would dissolve the active pharmaceutical ingredient (Aspirin) into the oil and prevent it from mixing into the blood and being efficiently carried into its target tissues/organs.

Another notable, and desirable feature about the 80-20 emulsions is the constant viscosity of the emulsions prepared at a mixing speed of 300 RPM. This was observed in a total of five emulsions prepared with the same composition at 300 RPM. This indicates that these emulsions remained stable for at least a 24-hour period. In other words, this provides a "stability window" where the emulsions could be gelled into an emulgel without sacrificing much of its structural integrity.

Figure 22. Volumetric fraction of water vs. mass of aspirin dissolved

Considering a linear change in solubility of the drug into the aqueous phase, figure 22 was constructed. The graph considered the drug loading capabilities of Aspirin into the aqueous phase. It was then determined that the volume of the altered aqueous phase would be between 2 mL and 4 mL. Utilizing the solubility graph displayed in figure 22, having an ideal volumetric fraction of water being 80% for the aqueous phase indicates that the working volume for the aqueous phase is approximately 4mL to fully dissolve the 81mg dosage of baby aspirin which is approximately a 64% decrease in volume compared to the current 11mL volume of the aqueous phase. This would prove to be beneficial for companies which would produce these devices in bulk. Moreover, this would increase the overall quality of life of people who would be administering the patches chronically due to their small, convenient size.

Once separation and viscosity studies were completed, 80/20 emulsions were gelled through the addition of Sodium Alginate into the aqueous phase. Sodium Alginate is hydrophilic in nature, therefore, it is desirable to include the minimal amount of SA into the emulsion needed to create a stable transdermal drug delivery device without risking increasing the hydrophilicity of the patch. It is important for the emulgel to be hydrophobic due to the hydrophobicity of the skin's outer layer, the stratum corneum [31]. This indicates that delivering an aqueous phase into the blood would require the presence of a lipophilic carrier that would be able to deliver the drug loaded phase to the boarder separating the stratum corneum from the viable epidermis (the hydrophilic portion of the skin). The hydrophilic phase would then be able to diffusion through the viable epidermis with ease and reach the blood capillaries to deliver the drug.

Multiple emulgels were formulated with weight percentages of sodium alginate ranging from 1 wt% to 3 wt% in 0.5 wt% increments. After allowing the patched to dry, it was noted that the emulgels prepared with 1.5 wt% SA exhibited the most consistent color and consistency. Lower weight fractions did not dry out properly while higher weight fractions were not desirable due to potential issues of hydrophilicity. After preparing multiple emulgels with the desired specifications (80/20 emulsions gelled with 1.5 wt% sodium alginate), hydrophobicity studies were conducted. This was done through the use of a Kruss K-100 force tensiometer. The setting used was dynamic contact angle which provides the contact angle between an object and a desired liquid. The emulgel was held by an alligator clip placed inside the machine and dipped in deionized water to record the contact angle between the patch and water.
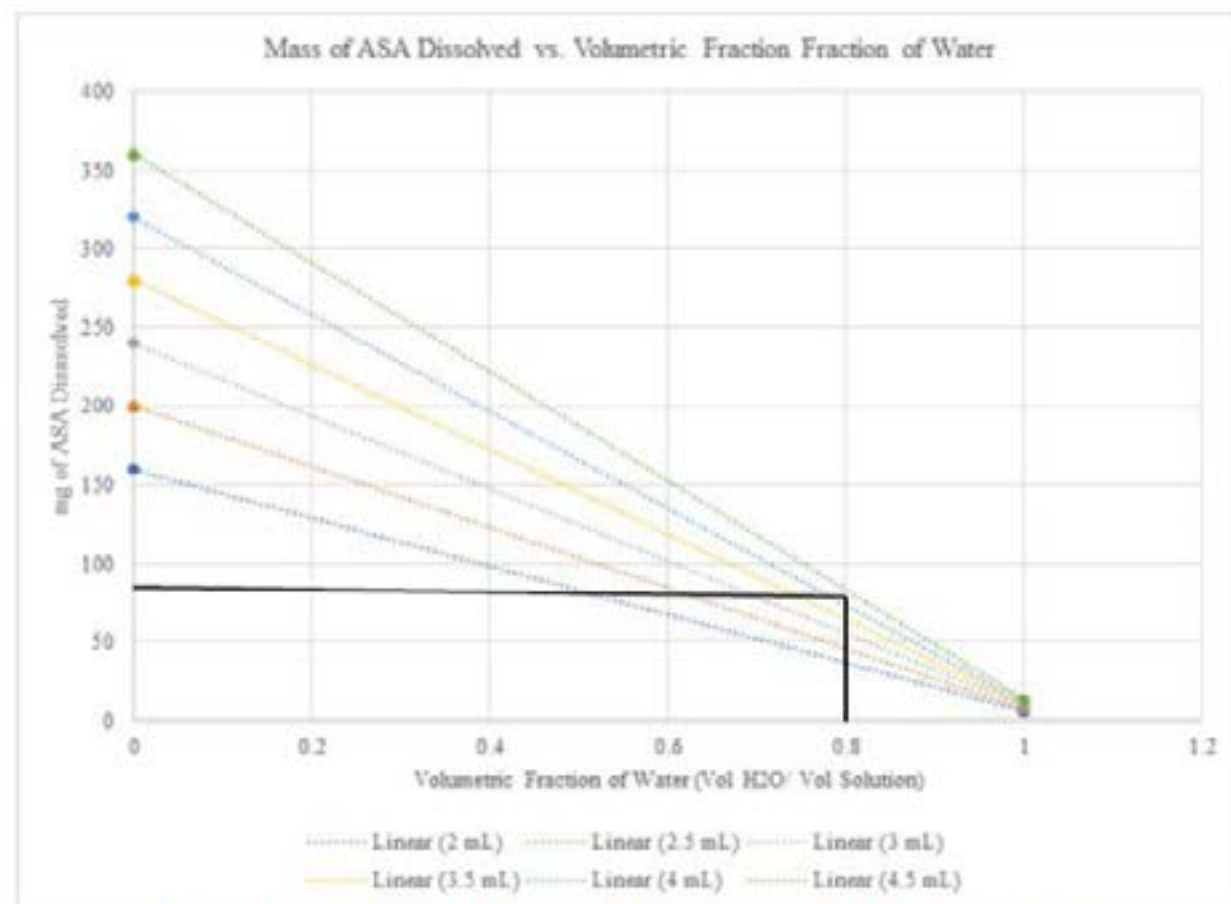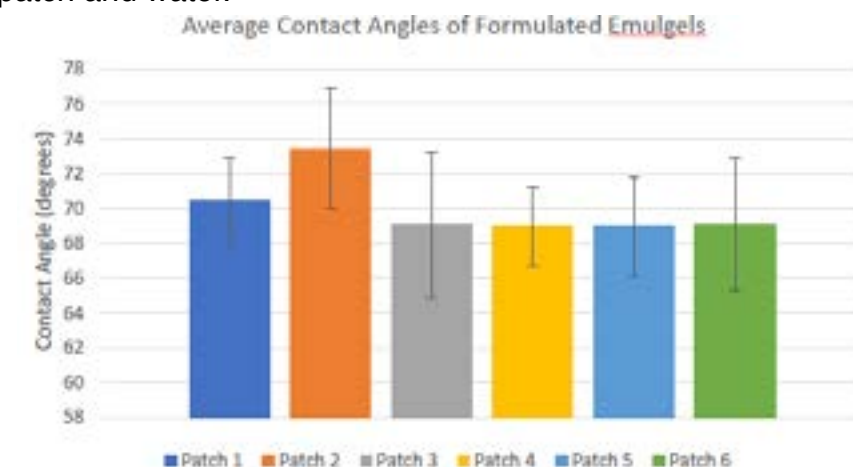
Figure 23. Contact angle measurements of different formulated emulgels

Figure 23 is a graphical representation of the contact angle between water and the emulgels. Each of these patches were formulates with varying thicknesses to observe any correlation between patch dimension and contact angle. In each case, the contact angle averaged at around 70 degrees indicating no relationship between the emulgel thickness and its contact angle. Nonetheless, a more important conclusion to infer from the graph in figure 8 is that the emulgel was hydrophilic. A hydrophobic emulgel should exhibit a contact angle greater than 90 degrees indicating a bad wetting. This result is not unexpected since the gelled emulsion contains many hydrophilic components including water and tween 80.

In the formulation of the emulsion, tween 80 was used as the surfactant which lowered the overall surface tension of the emulsion in an effort to increase its stability. However, the intrinsic hydrophilicity of tween 80 contributed greatly into the observed contact angle. Therefore, any effort exerted to remedy the hydrophobicity issue should include an alteration of the surfactant to a low hlb (more hydrophobic) surfactant such as Span 80 or a mixture of Span 80 and Tween 20.

Finally, the Franz diffusion cell was designed in SOLIDWORKS. The image below is one of the current prototype design of the Franz diffusion cell. The grey cap at the top is not mated into the design and below it exists a disk with a hole (washer design) to allow for the drug to diffuse through the "skin" and into the PBS solution.

Figure 24. Franz diffusion cell prototype.

The cell was constructed part by part before joining them all into one file where some parts can be mated into others. The mating process would ensure that the parts are fully connected and would print out as one continuous object. Inside the cylindrical body, there exists another cylinder at a concentric position to contain the PBS solution which would be sampled through the port on the left. The cap present on the top portion of the design is the bottom part of the donor chamber. However, the remaining piece of the donor chamber compartment only serves to facilitate placing the patch into the donor chamber and thus is not an integral part of the design/ Therefore, this preliminary design serves as a proof of concept for the feasibility of printing out a Franz diffusion cell with the potential of full operation.

Conclusion and Future Work

In conclusion, preliminary studies proved that creating a water in oil emulsion with an 80% water and 20% ethanol aqueous phase proved to be the most promising approach to creating a transdermal drug delivery device for Aspirin. Viscosity and separation studies displayed promising results concerning the stability of such a device. Nonetheless, issues concerning the hydrophobicity of the emulgel need to be addressed and that could be done through the use of a hydrophobic emulsifier such as Span 80.

In addition to alteration of the surfactant, future work may include using a homogenizer to ensure the uniform spread of small droplets within the emulsion. Moreover, more accurate droplet size characterization could be achieved using diffusion light scattering technology. Nonetheless, the methods utilized in this project do provide an accurate estimate of the relative size of droplets within the emulsion. Finally, diffusion studies may also be carried out using a Franz diffusion cell to estimate parameters such as the time of application of the drug delivery device.

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The Effects of Colorism and Inaccurate Depictions of African American Women in the Media

Abstract

In the 1930s, the very first time African American women (cis-woman, non-binary, gender-fluid, and transgender) were given the opportunity of representation in the television (TV) industry, they were most commonly portrayed in Hollywood films in dehumanizing and inferior ways. Stereotypical character tropes such as the Jezebel, Angry Black Woman (ABW), and Mammy are still present and being used to stigmatize African American identities in television (Adams-Bass, et al.); the limited roles African American actresses are offered only contributes to this problem. By revealing these truths, this study is working towards a reclaiming of African American women histories, which in turn will help to promote both individual and societal benefits (i.e., an empowered and improved sense of self-esteem and overall mental health and hopefully newfound equity within target institutions (Adam-Bass, Grable, Howard-Hamilton; Richardson; Yosso). The scholars listed have either analyzed the historical effects of stereotypical character tropes used against the African American community as a whole or have created a language that can clearly explain ways in which African Americans can work towards empowering and enhancing the overall morale of the community. Black Feminist Thought, a framework coined by Patricia Hill Collins, will be used as a framework to analyze the importance of interrogating these tropes (Collins). The analysis of the modernized versions of these tropes and their effect on young African American women's self-esteem may help to reform the dehumanization caused by these tropes, which ultimately gives this research its purpose.

Introduction

I chose this topic because I related to it in terms of experience. For example, my racial background and how I never seemed to quite "fit in". Being of a mixed race, both Taiwanese and of African American descent, I found myself constantly being questioned of my nationality by those I was associated with of African American descent. Furthermore, when I tried to connect with those of Asian descent, I noticed there was still that unexplainable disconnection. It was as if I wasn't "Black enough" to be considered African American nor "Asian enough" to be Asian. But if I had to choose, the obvious was trying to relate with those who I physically looked like. Eventually, I realized I was starting to do the same thing with African American actresses in film. This of course, led me to experience the effects of low self-esteem which soon began affecting my personal relationships, causing an obvious identity crisis. As a result, I was determined to research more on how what I, as well as other young African American women (cis-woman, gender-fluid, and transgender) are decoding and accepting in regards to popular television (TV) shows. Are the messages being conveyed truly affecting how young African American women are viewed by others and more importantly how they view themselves? I hypothesize that this study will provide significant insight into the realm of African American women's thought, which is a subject that is often silenced in various major ethnic and women's studies conversations. Subjects who participate in this study will be given an unobtrusive and uncensored space to use

their voice which may not only promote the feeling of liberation but also, act as a form of deliverance and resistance. Furthermore, subjects may feel a release of tension within their bodies and notice an improved sense of self and power. By freely sharing one's experiences, truths, and history (without the influence and impact of stereotypical character tropes) one may find an improvement in their mental health. Moreover, if subject responses are used in a written collection and distributed for others to be educated, it may lead to societal and community benefits as well, which in turn would be beneficial to the Ethnic & Women's studies community of scholars and research. For example, the overall strengthening of future generations of the young African American women community.

False depictions of African American women in the television (TV) industry have been around for decades. The majority of these stereotypes are rooted in slavery and their repetitive use since then has created toxic generalizations. Character tropes and entertainment performances have centered the ridiculing of African American culture in America since the 1930s, where the first minstrel shows were performed in New York by White performers. These performers sported blackened faces and ragged clothing to symbolize and mock enslaved Africans from Southern plantations. In the 1930s and 1940s, tropes were created that continued the stereotyping of African American women in particular. As time progressed, these false depictions (i.e. Jezebel, Angry Black Woman (ABW), and Mammy) eventually began negatively affecting both the African American actresses as well as young African American women viewers. Because of these demeaning stereotypical character tropes portrayed in films and TV, studies have shown there has been a decrease in self-esteem for young African American women, which can eventually cause a negative impact on the actual perception of not only themselves but people of color (Adams-Bass, Bentley-Edwards, Kotzin, & Stevenson). Furthermore, these character tropes may also have an effect on how one relates or differs in terms of skin tone, physical appearance or perhaps even social class. For example, a misinterpretation of how one perpetuates colorism, body image, or social class can easily force one into a battle with self-love and self-efficacy.

In this research study, I aim to focus on the possible results of the Jezebel, Angry Black Woman (ABW), and Mammy on TV contemporary representations of African American women and how this impacts the African American women who view these tropes. To explore this, my research asks the following question: what possible effects does television's contemporary representations of African American women have on the self-esteem of its viewers, particularly young African American women? The TV shows being included and analyzed inthis research are How to Get Away with Murder, Insecure, and All American. These shows propose potential self-esteem issues on social status based on class, skin tone and social status. Eventually, if taken out of context, these false narratives may play a crucial role in influencing a young viewer's mind during such a time where she will soon begin to develop what she believes to be her true identity. In the end, this study seeks to find: will these stereotypical character tropes impact the viewer while she is in a vulnerable stage of learning and growth making it nearly impossible to separate the difference between fact or fiction? Or are the character tropes portrayed easily deciphered as simply that, an actor's role which ultimately should be interpreted for entertainment purposes only?

Literature Review

In "That's Not Me I See on TV...: African American Youth Interpret Media Images of Black women'', 2014, Valerie N. Adams-Bass argues that adolescence is one of the most important spans of time in an individual's developmental life and with that, by way of engaging in "hypothetical reasoning" (Adams-Bass, 94), Black youth are capable of recognizing and contesting stereotypes against Black women. The author also discusses how the persistence of negative stereotypes being portrayed in the media may have a direct effect on the cognitive capacity of the Black youth population. Some of the relevant research questions gathered to help peek my interest were: "how do African American youth perceive images of Black women in popular media?", "do they recognize sexualized, exaggerated portrayals of Black women that scholars typically define as stereotypes?", "do they accept these images as accurate, reflective of reality, and unproblematic?", and "how do they interpret these images, overall?". The author dives deep into trying to figure out 1) how much of today's media our Black youth is truly grasping wholly and 2) of all the negative stereotypes being portrayed, how much of that is impacting their cognitive abilities "behavioral functioning" (Adams-Bass, 81). The purpose of this source is to explore Black youth's ability to recognize and/or define the negative stereotypes portrayed in Black media. As far as the gap is concerned, these authors are more focused on the connection between the cognitive abilities of adolescents and the images they are seeing in various media outlets. While the authors chose to take a more psychological approach, this article did help to inform my interest in looking into more on the effects stereotypical character tropes have on how African American viewers get treated by society and the possible effects on African American women viewer's self-esteem.

In "Portrayals of Black Women on Television & The Shift in Their Representation: An Analysis of Scandal & Insecure", Tyra Wooten (2019) utilizes occupational roles, physical appearance and stereotypes as a vehicle into determining whether shows like Insecure and Scandal are a progressive approach towards making a shift away from negative stereotypes or are they just preserving them? The author also discusses how the misrepresentations of African American women in Black media may impact the way society as a whole views and treats the Black women population. Studies show that because both series were directed and written by African American women [Issa Rae and Shonda Rhimes], this represents progressive leadership, which in turn highlights the shows' ability to shift towards enhancing Black women's portrayals on TV. While this article does include the character tropes being played by African American women in tv/media it doesn't touch on colorism or the self esteem [in full] of the African American women population [both youth and adult] in television and film industries. The article seems to be using the misrepresentation of African American women in tv/media as a way to answer the overarching question of whether shows like this help improve society's outlook on African American women. This article helped to inform my choice in TV shows for analysis and my emphasis on African American women.

In "Nothin Else Mattered After That Wig Came Off": Black Women, Unstyled Hair, and Scenes of Inferiority", Kristin Denise Rowe analyzes the significance behind the on-screen wig removal scenes and explores why they resonate with Black women, in particular. The main argument was that the natural hair reveal scenes would "capture representations of Black women's experiences of beauty and hair politics, as negotiated through the

'inner lives' of these characters' ' (22). The author's methodology included a content analysis of TV/ media (i.e., How to Get Away with Murder, Beyond the Lights, and Being Mary Jane) and bringing into the conversation theoretical frameworks such as Dissemblance and interiority ('inner lives'). In a qualitative study, the author was able to collect viewer's responses to the randomized selection of scenes she provided through platforms such as social media, news articles and comedian Phoebe Robinson's book titled You Can't Touch My Hair: And Other Things I Still Have to Explain (2016). While the article does discuss Black women's relationship with their own hair and beauty politics [in tv/media]; which is significant when in conversation with self-esteem. One thing this research doesn't include is an extensive analysis on stereotypical character tropes played by African American women or the possible effects of messages being conveyed by modern TV shows in connection with the viewers self-esteem. The gap within this article helped to inform the final TV show analysis list and my interest in the effects of modern shows and stereotypical character tropes on young African American women viewers.

Theoretical Framework(s)

According to my research, African American women have been misrepresented in television (TV) and film since first being aired on June 14th, 1939, by way of stereotypical character tropes such as the 'Mammy', 'Jezebel', and 'Angry Black Woman (ABW)'. These inaccurate depictions have proven to have effects on the way that society may view and/ or treat this cohort of women. In this paper the idea of there being possible mental and psychological effects on the self-esteem of both the viewers and African American women population as a whole will be explored. With that being said, as far as my theoretical frameworks are concerned, I plan to use: Black Feminist Thought, Intersectional feminism, Critical Race theory with a BlackCrit extention, and 'Reception theory'.

Due to the fact that there has never been a set "place, space, or stance" (Howard-Hamilton, 21) provided for the cohort of African American women trying to share their experiences; Collins's paradigm Black Feminist Thought (BFT) posits the significance of their ideas to the conversation. BFT consists of three key components: the first being the fact that it has been "shaped and produced even though others have documented their stories" (Howard-Hamilton, 21), the intersectionality that follows suit with the experiences between and among African American women, and finally the commonalities that exist among them [i.e., age, religion, sexual orientation, socioeconomic class] that have assisted in the revealing and representation of their experiences in various contexts. In summary, BFT brings out a newer and deeper awareness of the African American women, those of which are willing to actively pursue finding their own voice within, rather than looking for validation on the outside. This framework is significant to my research because it allows me to utilize the African American women experiences in a way that will not only help encourage these women to "develop, redefine, and explain their own stories" (Howard-Hamilton, 22) but also, highlight the importance of "self-valuation, self-definition, and knowledge validation" (Howard-Hamilton, 22), which in turn, would help replace the anti images present in their minds. This framework will most definitely act as the foundation of the project because it brings into conversation the importance of African American women experiences, identities, histories and so on.

With Black Feminist Thought as our foundation, a much strong argument would be present if we were able to take the stories of these women and used them to conduct a mental comparison to other womens' experiences as a whole. This way we can truly hone in on the source of the problem, which can be acts of discrimination, colorism, and so much more, thus creating true acts of social justice. Intersectional feminism, a theoretical framework coined by Kimberle Crenshaw, aims to create a more just future for everyone by utilizing a lens focused on teaching individuals how we can better understand what fighting for justice truly looks like. Taking an intersectional approach to analyzing how people's social identities are constantly overlapping can create this compounding experience of discrimination. This framework is relevant to my research because it allows me to take the intersections that already exist in the world and narrow them down to just women's experiences. Intersectional feminism is also significant because when put in conversation with Collins's Black Feminist Thought (BFT) it highlights the intersections present in the identities and experiences of women in general, but more specifically African American women.

Now how, if at all, can we take what we have learned from the voices of young African American women and begin to further move in the direction of challenging the previously accepted approaches to social justice, for African American in particular. Through Critical Race Theory (CRT), which is where scholars and activists are attempting to decolonize and challenge the accepted and liberal approach to racial justice. CRT is an intellectual movement in which one of the main goals is to argue that race is not a biologically grounded or natural way to categorize human beings, but it is in fact a socially constructed concept used to exploit and oppress people of color (POCs). While CRT's framework is at the foundation of BlackCrit, I plan to extend my research into the realm of BlackCrit in order to find an answer to my research question. Putting into conversation CRT, BlackCrit, BFT, and Intersectional feminism will allow me to not only focus on the empowerment of Black experiences, aspirations and identities while still critiquing and decolonizing the oppressive measures of today's social justice system, but it will also help me to find the connection with these experiences and that of the African American women population.

Last but not least, my research would benefit from using reception theory because it derives its results from collecting the reactions and experiences of an audience after watching a show, reading, etc. This theoretical framework will aid my research in allowing the interview process to run smoother. Having a framework prepared to act as a catalyst for my interview process is going to be key in the uncovering of my research question's answer, especially when put into conversation with the other theories.

Finally, working with all of these frameworks in conjunction with one another helps to create a safe space for the African American women participating (as well as all those who read my written piece, if any) in my study by way of allowing them to freely speak out on their personal experiences. Black Feminist Thought and Intersectional feminism work together to create a platform for African American women to be heard. Critical Race Theory, specifically BlackCrit in particular works alongside both Feminist frameworks to make sure that African American stories are formally part of major Ethnic & Women's studies conversations. Finally, Reception/ Audience Theory works to combine the other frameworks

with the messages being conveyed through moden TV shows in regards to young African American women viewer's self-esteem.

Methodology

Given the research question, this study will enact a multimethod approach: oral interviews, surveys and media literacy. The criterion for subjects includes self-identification as an African American and as women (cis-woman, non-binary, gender-fluid, and transgender); subjects must also be within the age group of 18 to 26 years old. To ensure in-depth data and external validity, sample size is estimated to be 20-30 subjects. Researcher will design a 3-part, standardized questionnaire that will be delivered verbally (in English). In order to collect applicable data and to ensure internal validity, all subjects will be asked questions from the same script, and their responses will remain anonymous. The researcher will also ask each participant to provide a pseudonym for future publication purposes.

The first part of the interview will include basic data gathering questions regarding the amount of time subjects typically spend watching television, the types of shows subjects watch, and questions to measure the participant's current knowledge about African American women character tropes on television. After this stage, subjects will be asked to the Rosenberg Self Esteem Scale to determine their self-esteem baseline. Subjects will then be shown several short vignettes from either How to Get Away with Murder, All American, or Insecure. The vignettes will highlight an African American woman on television that replicates a trope: the Mammy, the Angry Black Woman (ABW), or the Jezebel. Then, after a brief break, I will conduct interviews with each subject to discover what kind of an effect watching these tropes has, if any, on their self-esteem as African American young adults. This interview will conclude with another Rosenberg Self Esteem Scale to determine if any of the prior conversation and screening had an effect on the subject's self-esteem.

In regards to media literacy as a methodology, this is an umbrella term that encompasses a variety of approaches focusing on the development of critical thinking skills in reference to all types of media, building "an understanding of how media messages shape our culture and society" (Media Literacy Now), and provides people with the necessary tools that can be used "to advocate for a changed media system" (Media Literacy Now). Applying media literacy education to the research study will encourage and empower subjects to exercise their ability to critically think through media messages and create their own meaning. This in turn might invite subjects to interrogate the tropes they have been taught to accept.

Media literacy is an umbrella term that encompasses a variety of approaches focusing on the development of critical thinking skills in regards to all types of media, building "an understanding of how media messages shape our culture and society" (Media Literacy Now), and provides people with the necessary tools that can be used "to advocate for a changed media system" (Media Literacy Now). Applying media literacy education to my research study will encourage and empower participants to exercise their ability to critically think through media messages and create their own meaning. This in turn will benefit the "health and well-being of America's children" (Media Literacy Now), African American women, young adults in particular.

Findings

I was fortunate to conduct a total of ten interviews, all with African American identifying women who were between the ages of 18 and 28. These interviews helped me cultivate a space for a better understanding of how messages being decoded from various contemporary television (TV) shows may contribute to both the strengths and weaknesses of women in the African American community. Although I wasn't able to find a full-fledged answer to my research question, my data collection demonstrates three valuable takeaways that can effectively begin the process of searching for an actual solution. Through continued conversations regarding my research, ethnic and women's studies departments worldwide will allow me to further cultivate these kinds of safe spaces for African American women's voices to be uplifted and heard.

Media Literacy

It's no secret that the media, television in particular, has the power to both promote and destroy stereotypes. This is especially true of the character tropes examined in this study (i.e. Sapphire/ Angry Black Woman (ABW), Jezebel, Strong Black Woman (SBW), Mammy). The traditional encoding/decoding of mass media communications is said to move in a linear fashion, moving from the 'sender' through the 'message' and to the 'receiver'. According to this structure, the sender (i.e. TV producers,writers) formulates the message and creates a supposed fixed meaning, which is then communicated transparently and directly to the recipient (i.e. audience, viewers). However, according to Stuart Hall's Encoding/decoding (1973) and the likes of this study, it has been argued that "(1) meaning is not simply fixed or determined by the sender; (2) the message is never transparent; and (3) the audience is not a passive recipient of meaning" (Mambrol 2020, 1). This argument is relevant to this study because it provides my research with grounds to further connect with my participants' responses to the media clips I presented to them. Studies have shown that with repeated exposure to TV shows featuring African American characters, specifically women; this can create negative perceptions of African American women, as well as of the community as a whole (Adams-Bass, Bentley-Edwards, Stevenson 2014, 79). To set in motion the analysis of my findings, I would like to start with a brief overview of media literacy and its importance to my interview process, as well as the interview layout in general. I used media literacy to bring forth yet another beneficial aspect to participating in my study, which was the overall development of my participants critical thinking skills in regards to mass media, specifically TV. At the start of the interview, I used the Rosenberg Self Esteem Scale and a pre-interview google assessment to 1) gauge where my participants were regarding their self-esteem and 2) get an estimate of basic information regarding how they interact with media, specifically TV. In regards to the Rosenberg Self-Esteem Scale (See Figure 1), this survey posed significantly unexpected results, due to them being extremely skewed and void of an actual pattern. While I can't one-hundred percent say that age has a significant impact on my participants overall confidence levels; I will say that there seems to be an effect on how susceptible they are to accepting traditional and socially acceptable mass media messages. My younger participants were more willing to accept messages and were less likely to be aware of the hidden mass media messages present in popular TV shows, whereas this wasn't the case for my older participants.
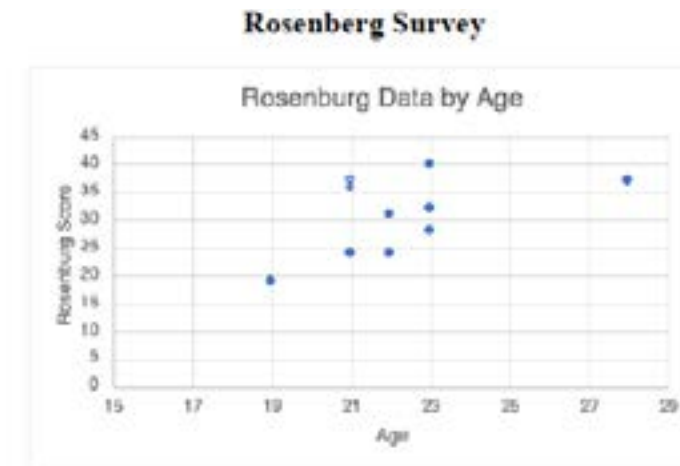
Figure 1. Rosenberg Self Esteem Scale data collected and transformed into a graph for visualization of the level at which my participant's self-esteem was throughout the whole interview process.

Following the Rosenberg Self Esteem Scale was the Google form assessment. The topics about which my participants' responses posed the most variation were related to the following two (2) questions:

1. Do you feel like you embrace what you consume through media, specifically television?
2. How aware are you that different television stations have underlying meanings embedded in their TV shows?

Embracing what you consume

Analysis of the unstructured survey related to whether or not my participants embrace what they are consuming through media, TV shows in particular. The responses suggest that since more of my participants are embracing what they are seeing on TV (see Figure 2).
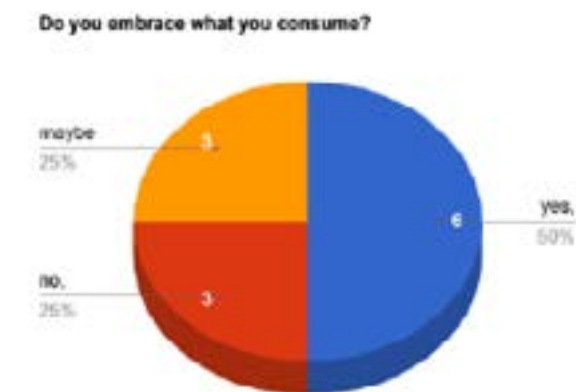
Figure 2. Pie graph shows the percentage of my participants who embrace what they consume on TV.

Some of the comments offered by my participants (regarding whether or not they embrace what
they consume) are as follows:

> "I think that when a show has people who look like me or are representative of
> my culture and my experiences, I embrace what I consume! When it seems like a
> show falls too heavily into the realm of negative stereotypes or trauma porn, I get
> annoyed and feel like the show has actually been made for audiences that are not
> Black."
> "Yes in both positive and negative ways."
> "I do but with a grain of salt. I don't hold everything to a high standard and try
> not to embody everything that I see."
> "It depends on what I see. Sometimes I do."

Clearly, embracing what they are consuming through media, in the minds of my
participants, enhances their exposure to mass communication messages, via the TV
shows they are watching, and that in turn is teaching people what should and should not
be deemed socially acceptable behaviors (Adams-Bass, Bentley-Edwards, Stevenson
2014, 81). My study reveals that depending on a person's age, they will decode and encode
the information differently, which in turn is critical to note because this form of encoding
messages is contingent upon the participants' age, something that will be further discussed
in my call-out theme.

Awareness of the underlying messages on TV

Based on my participants' responses to whether or not they're aware of the
messages present in TV and the help of my Reception [Audience] Theory theoretical
framework, I was able to categorize my participants into three groups: dominant, negotiated,
and oppositional readers. The dominant readers are those who simply internalize
the creative works being given to them by the director [of the TV show] with no extra
attachments. This category would be representative of those who are unaware of the
mass media messages. Next are the negotiated readers and these audiences are partially
aware of the messages, but choose not to refute or question them, because it's easier
to just accept what is typically already deemed socially acceptable. Finally, there are the
oppositional readers who are not accepting of the hidden mass media messages conveyed
on TV (Communication Theory). This group is exemplified by those who are aware of the
messages and have begun to question their purpose and sometimes overall existence.

Participants of this survey offered a variety of responses regarding their awareness of
the underlying messages that are being conveyed by TV shows. The results of this question
had an unexpected turnout, especially as we see time progressing, technological advances
continuing to expand media platforms, as well as the ways in which communication
mechanisms continue to evolve. Most (58.33%) reported that they were aware that hidden
messages are present in the TV shows that they watch. But, the surprising response was
the fact that there are people who are completely unaware and oblivious to the hidden
messages they're subconsciously internalizing.

Studies have shown that with more research beginning to provide a broader framework
for how exposure to mass media messages can affect the relationship of racial identity
to how individuals, women in particular are interpreting and responding to media
images and representation of Black women highlights where society as a whole are
blurring the lines between what is actual reality and what they are perceiving to be
reality, through what's being shown on TV (Adams-Bass, Stevenson, Kotzin 2014, 369).

Awareness of the underlying messages on TV

Aware	In between	Not Aware
58.33%*	16.67%*	25%*

Figure 3. *percentage equals the total combination of aware, in between and not aware responses.

Overall, these two surveys were significant to my data collection process because
they helped me to be sure that each participant had an equal and fair opportunity to begin
at the same level as all the others. They also aided in providing background statistics on my
participants ability to 1) decode hidden messages (Hall, 1973), 2) call out the issues with
the messages, and [if they make it to this step] 3) begin the process of asking questions,
taking a stance or looking for solutions to fix the problem. The gift of media literacy is that it
helps us critically think of TV shows and that's how I, alongside my participants, were able
to cultivate these three themes.

Single Stories - Strong Black Woman (SBW)

Although I have been exploring a total of four character tropes (Sapphire/ Strong
Black Woman (SBW), Jezebel, Angry Black Woman (ABW), mammy), I've decided to only
analyze the two that I felt ignited the most reaction out of my participants. This theme will
be broken up into two sections: Strong Black Woman (SBW) and Jezebel. Single Stories,
according to author Chimamanda Ngozi, are outrageously simplistic statements and or the
occasional false perception we as a society create to describe persons, groups or nations
(2009). In the context of this study, the single story written about the SBW is that she is
supposed to represent how the ideal African American woman should act, according to the
characteristics deemed socially acceptable by the colonized masses. By definition, she
should be someone who is capable of showing emotional restraint, independence and is
the caretaker for all her loved ones regardless of her own mental capacity. When asked to
describe the SBW in her own words one of my participants said:

> As a Black woman in today's society you almost feel like you have to be the Strong
> Black Woman to get things done and combat the obstacles that are already put in
> the way of the African American community. Being forced to hold everything in and
> carry the weight of all the emotions and the livelihood of all those you care about on
> your back is immensely tiring. Then, adding in trying to take care of yourself, but not
> having the mental capacity, energy or support from society or your loved ones causes
> these women to crack. Furthermore, now that you've cracked you're no longer
> playing your role and because we live in a world where society is constantly telling
> you that as an African American woman you need to be this way to make the rest of
> the world comfortable; it becomes a vicious cycle. (Participant, ZS)

This quote truly encapsulates the overwhelmingly emotional response towards the effects of having to play the SBW, I received by the majority of my participants. Finally, with the use of Critical Race Theory (CRT) and its BlackCrit extension, I was able to create a strong platform that felt both safe and uplifting enough for my participants to speak their minds freely. CRT, its BlackCrit extension and Reception [Audience] Theory, worked in conjunction with one another in this section to be sure that the messages provided by the directors of each show [All American, How to Get Away With Murder and Insecure] and I, the encoders, were thoroughly decoded by the audiences [participants] and were able to be understood in the realm of decolonizing the single stories normalized by society.

Jezebel

Historically, white women were society's representative of modesty and self-respect, which left their African American counterparts to play the seductress. The oversexualized, supposed to be seductive, alluring temptress who is willing to use her body to get what she wants in the world. The full-bodied features present beginning at a young age, sexual attractiveness and overall exotic otherness of African Amrican women is spotlighted at a higher rate than the actual talent of the individuals playing the roles (Adams-Bass, Bentley-Edwards, Stevenson 2014, 88). In recent years TV shows and the entertainment industry have continued to play on these degrading ideals, which led to others, non-African American identifying individuals use of the stereotypical media representations they are seeing of African American women on TV to create their own expectations of how these women should act and respond to their microaggressive actions. During the interview process, I showed my participants a series of vignettes. One being a clip that was specifically created to place into the limelight all of the times in which the directors of the show wanted the audience to see main character Annalise Keating as a overly sexual individual, who was willing to use her body to get whatever it was she needed to succeed and survive. I ended up sharing a specific section of the clip in which Keating is shown sharing a loving interaction with her fling (at the time). They were affectionate through a kiss and hugs, she grabs his behind during the embrace and before she leaves for work, he hands her a smoothie he had made for her. Not only was the title of the video (before it was removed) solely addressing the "butt grab"; the video itself also goes to show how any form of loving interaction between African American couples will automatically create a space where non-African Americans will condemn African American women to the worldly and hypersexual being. This quote given by one of my participants is to exemplify a reaction to this sort of occurrence:

> "Instead of taking the time to actually get to know me as an individual, now you're beginning to project your expectations onto not only me but also, onto the community of African American women as a whole population. When TV shows portray us African American women as hypersexual, it's misleading to the world. This needs to be fixed and fast."

This quote is the perfect segue between my participants' acknowledging the fact that there is a problem and them now beginning to call it out. The Jezebel trope is one that continues to incite strong emotions out of the African American community because of the dangers that can come with being seen as hyperrsexual, especially when it starts for most

young African American girls at an extremely early age. The first step to finding a solution is to be aware of the fact that there is even something to be aware of. The next step is, now that you know there is something inherently wrong with the way the media, TV in particular is portraying African American women, will you choose to say something or will you become part of the problem by continuing to allow the issue to be further normalized?

Call-Out

A newfound desire for a sense of hyper awareness surrounding this issue has been crafted by my participants' through their responses and this can be seen by this quote: "Some people have never even met a Black person before and this is the only representation they might have of them... it's kinda like propaganda. Its easier to believe what's right in front of you than to go out and experience it for yourself or do your own research" (Participant, TS). This quote is significant to this section because it demonstrates how we're so quick to just normalize and accept the messages and stereotypical character tropes we've repeatedly seen on TV. For example, the previously mentioned SBW and the Mammy character trope. Both the SBW and Mammy tropes leave African American women feeling exhausted and demoralized. The seemingly ceaseless internalization of the societal acceptance of lower standards for African American women comes from the neverending cycle of having to fit into these toxic roles, in order to make sure everyone else is comfortable, fed and surviving. The vignette that stood out the most with my participants was a scene from How to Get Away With Murder, called the pillow scene. The vignette consisted of Annalise Keating having what would seem to be a mental breakdown. She is performing a therapy exercise that she was recommended by her therapist, which was to punch a pillow as she expressed how she felt at the time. Throughout the scene Keating makes comments like "you're no failure, you're not trash, you're not cold, you're not a bitch, you're not ugly, you're not disgusting, you're not a slut", all while punching the pillow after each statement. My participants and I were able to agree that this in fact, is a sad realization. This is the kind of emotional breakthrough we as a whole African American female population wish we could experience, but are stuck feeling emotionally and mentally tied down to these societal norms placed on us. Even with the ability to acknowledge its toxicity and harm we still choose to just try to overcome it and move forward, in order to hopefully close that gap between everyone else and us [African American women].

In a world where there is already a limited amount of TV show options that work to uplift African American culture and Blackness, questions like "why can't we just be; why must we have to decipher what we are character-wise? Is it not enough for us to just be?" (Participant, SY) truly helps individuals protect their self esteem. This is especially important when it's an almost everyday occurrence that society attempts to undervalue and minimize their [African American women] existence and personal attributes (Grable 2005 ,61). Because I had access to a wide array of women both at the beginning of their college career and well into their masters, I've been able to see how time and age affect the rate at which an individual may internalize what they are seeing on TV. After analyzing my data, it would seem that my younger participants [aka the younger generations] are more likely to accept the already heavily normalized and harmful messages that come from the TV shows they are watching and this directly affects their self esteem as they age. But, those who are already deeper in their higher education journeys are less likely to internalize the negative

messages they are decoding from the TV shows they watch. Instead of internalizing these harmful media messages, the older participants seem to have an easier time picking and choosing what they are and are not willing to accept. Furthermore, of the messages they are not willing to accept, they are more prone to start a dialogue with someone and call-out the issue rather than allow it to affect their self esteem. BFT was pertinent to the progression of this theme because it enabled all of the women who participated in this study to feel encouraged and empowered through sharing their thoughts. Participants made it clear to me, as the interviewer, that this study gave them a safe space to have a conversation about an issue that has been sitting heavy on their chest for a while. All in all, the overall responses received by my participants in this section exemplify their desire to Call-out the issue through their bravery and willingness to become vulnerable with me throughout the interview process and share their own personal experiences.

Reframing the Single Story

Now that the issue has been identified and we have begun putting what has been acknowledged in conversation with other normalized mass media messages; this final theme is where instead of finding a guaranteed solution to the issue [due to its large propensity to society] my participants have started the process of solution-seeking through coming up with ways in which they would like to see change. They have identified at least three ways: 1) creating new avenues that genuinely explain the Black experience, specifically of our women, 2) the complete erasure of all stereotypical character tropes, and 3) allow African American women to write their own stories, which sort of falls under the erasure of all character tropes. This is illustrated by the following quotes:

"When any series falls too heavily into a trope they; rather than being progressive, actually become detrimental because it solidifies in the minds of others that these are the four categories that we have to be confined to... there needs to be more avenues that really explain the Black experience, specifically of our women." "What are the strengths of a strong black woman, without making her want to pull her hair out... ERASE all characters and just let Black women be women. Let Black women be soft women." "With the way the world of media is, fake news doesn't even allow us as African American women to write our own story."

The use of Intersectional Feminism as a theoretical framework was relevant to this study because of its desire tto bring about a stronger understanding for how we as a collective community can better work to fight forr justice as African American women for African American women in the media, specifically on TV.

Conclusion

The purpose of this study was to explore how the African American female population interprets Black media messages conveyed through popular TV shows, specifically All American, How to Get Away With Murder and Insecure. While still lacking an official guaranteed solution to my solving my research question, the following previously stated responses were provided by my participants: 1) the creation of new avenues that genuinely explain the Black experience, specifically of our women,

2) the complete erasure of all stereotypical character tropes, and 3) allow African American women to write their own stories, which sort of falls under the erasure of all character tropes. These responses are made up of a summary of my participants' responses regarding what they feel should be done to combat the inaccurate portrayals that are perpetually normalized through mass media communications, especially through modern-day TV shows.

This research has taught me the importance of the promotion of a safe space, as well as the power that comes with one's willingness to learn and to use their voice to share their personal stories. My participants made it clear how impactful just being able to have these conversations was for not only them in general, but for their mental health. Several of my participants even went as far to express how the interview process gave them a space that allowed them to unleash their true selves, thoughts, and opinions without fear of judgment. The sense of relief I felt from my participants was why I wish to continue to have these conversations. As far as the future directions of this research is concerned, I plan to hopefully begin the process of actually searching for potential solutions through finding a way to get my research heard by more students and faculty both inside and outside of the ethnic & women's studies department.

Furthermore, I plan, as mentioned earlier, to continue to further create spaces where African American women's voices are heard, uplifted and their stories are shared.

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Appendix
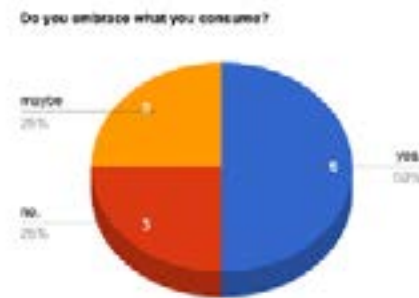
Figure 2. Pie graph shows the percentage of my participants who embrace what they consume on TV.

Awareness of the underlying messages on TV

Aware	In between	Not Aware
58.33%*	16.67%*	25%*

Figure 3. *percentage equals the total combination of aware, in between and not aware responses.

Interview Design

Part 1 I Rosenberg Self-Esteem Scale (survey)

1. On the whole, I am satisfied with myself.
2. At times I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I'm a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to feel that I am a failure.
10. I take a positive attitude toward myself.

Strongly Agree, Agree, Disagree, Strongly Disagree - (This scale will be included underneath each question)

Part 2 I Preliminary interview questions: Google form link

1. How often do you watch tv?
   a. [Ex: Less than 5 days a week, Daily, 2 hours a day, More than 2 hours a day, etc]
2. What kind of TV programs do you watch most?
   a. [Ex: News, Survival / Reality TV, Comedy-drama / Drama, Mystery, etc]
3. What makes you choose to watch a specific TV program? (select all that apply)
   a. [Ex: Popularity, Recommendations (from websites, friends, others), Provides up-to-date information, Aids in research/ studies, No reason/ random choice, Other]
4. I am curious about how you emotionally connect to the shows you watch, especially the shows where you feel "seen". How do you feel after finishing a season of a show where you saw yourself represented? (select all that apply / leave room for conversation)
   a. Feel empty
   b. Find another show to watch
   c. Read the reviews/ fan fiction
   d. Explore the inner workings of how the show was made
   e. Talk to someone else [friend, colleague, etc]
5. Do you feel like you embrace what you consume through media, specifically television?
6. How aware are you that different television stations have underlying meanings embedded in their TV shows?
7. Do you feel like you've been able to identify the different messages that are being conveyed in today's TV shows?
   a. How identifiable would you say these messages are?

Part 3 I Vignettes (short video clips)

1. Insecure
a. Sapphire/ Angry Black Woman (ABW)
i. Issa/Molly scenes (0:25-2:35 & 12:36-13:20) - [CONTENT WARNING-LANGUAGE]
2. How To Get Away With Murder a. Jezebel
i. Annalise & Eve (full clip)
ii. Annalise & Nate (1:20-end)
b. [modern] Strong Black Woman (SBW)
i. Annalise pillow scene [CONTENT WARNING - LANGUAGE] 3. All American
a. Mammy/ Strong Black Woman (SBW)
i. Grace James pep talk w/ carter (0:52-1:43)
ii. Pep talk w/ Billy (Start-0:32) 4. Spencer Grace James speech (0:15-1:00)

Part 3.5 I Corresponding questions following short video clips
Insecure
1. Do you feel like Issa Rae's portrayal of the middle aged black woman is true in regards to academic success, occupational desire, and fulfillment of relationship status and of gender roles?
2. Would you say that seeing successful representations of African American women [although they too are struggling] on popular TV shows helps to boost your self-esteem? Why or why not?
How to Get Away with Murder
3. When watching HTGAWM did you notice the various stereotypical character tropes that were played by Annalise Keating?
4. How does the hyper-sexualization of African American women on TV make you feel about yourself and the African American women community as a whole?
All American
5. Do you think that the probability of success for kids raised by a single mom is higher than that of those with a single dad?
6. Does Grace James resemble anyone close to you? If so, how does it make you feel to see being represented on TV, a single Black woman raising her sons by herself, while also successfully pursuing her own dreams?
Part 4 I Final questions
1. Do you think these series are progressive uses of the stereotypical character tropes that are to accurately represent African American women on television?
a. FOLLOW-UP: Do you think that what you're seeing on these TV shows are capable of directly affecting your self-esteem?
b. Do you think television shows have the power to destroy and promote stereotypes?

Hernandez Anais   **TikTok's Strategic Influence on Political Communication and Campaigns**

Abstract

TikTok is a video-sharing app that has quickly evolved into one of the most used social media apps globally, with over 2 billion downloads. TikTok was first known as a platform for young users who create dancing and lip-syncing videos, but it has evolved into a platform where people of all ages express themselves and their beliefs. Politics-related videos quickly became a popular trend, with political views and discourse having a wider reach. Videos were made to engage voters of each political party, which may have influenced the 2020 presidential election between Donald Trump and Joe Biden. This study aims to understand how these videos framed the candidates and investigate the influence of the social media app on the 2020 campaigns and public discourse.

Introduction/Literature review

Social media has become a part of the political world over the last decade. It has become a source of information that society relies on. The dependence on social media has led to misinformation influencing public opinion. Over the last few years, the social media app TikTok has gained power in the political environment and could even be considered a campaign tool. TikTok is a social media platform founded in 2016 by the Chinese company ByteDance. Its primary use was dancing videos created by teenagers, but over the years, TikTok has shifted and now caters to people of all ages. This social media platform is no longer just an app known for dancing videos, but it provides content that teaches others. As TikTok use is skyrocketing, it is important to investigate it. It has become one of the leading social media applications used today by all people because of its influence. Because all types of people are using this social media app, it needs to be studied in the context of political campaigns since misinformation on social media platforms has been increasing.

During the 2020 presidential elections, TikTok was one of the leading social media platforms where individuals voiced their opinions and beliefs, spreading bias and misinformation. Politicians from all over the world have also joined TikTok to gain popularity amongst voters. Politicians and their media teams use TikTok to create a trusting relationship with potential voters. They create content that will target their audience's beliefs and influence their opinions. In previous elections, politicians have used social media, such as Instagram, Facebook, Google, and YouTube. However, TikTok is the newest social media app they are joining to generate favorable views by potential voters. Another example of how powerful TikTok can be is the most significant political account on the app. The account is called "The Conservative Hype House," and it is one of the most influential political TikTok accounts, with more than 1.5 million followers. This account is known to promote content on Donald Trump, and during the presidential elections, they increased promotion for "Official Trump 2020" by providing direct links via their videos.

An emerging way to promote has been through TikTok celebrity endorsements. During the presidential election of 2020, Biden partnered with influencers like Liza Koshy to promote "pro-Biden." The trend "TikTok for Biden" was another way Joe Biden attracted the attention of the teen-dominated video app. Digital content creators and upcoming creators who had little to no experience making political advertisements helped Biden's campaign by creating Tiktok memes about why they chose to vote for Biden. Communication scholars have researched the use of social media platforms in politics. This study will provide a closer look at the social media app TikTok and how it helps frame candidates and shape public discourse.

Social Media as a Campaign Tool

Social media's algorithm patterns have impacted society, especially among younger generations active on social media (Stier, Bleier, Lietz, & Strohmaier, 2018). Research provides insight into how social media can produce fake news for presidential elections to explore social media's political and overall influence on society. Specifically, this article casts light on fake news and political implication related to the 2016 United States presidential elections (Stier et al., 2018). Researchers found that most information provided from non-factual sources is pure satire and misconducted false information that is misleading and discredits political candidates. Social media is a platform that can be used for good and bad—it provides an outlet for media like Facebook and Twitter to produce information that is not always factual and promote it to the public, which may influence political opinion. Because social media profoundly impacts how people engage with politics, the younger generations cultivate political identity online.

In the article, The Digital Architecture of Social Media: Comparing Political Campaigning on Facebook, Twitter, Instagram, and Snapchat in the 2016 U.S. Election, Bossetta (2018) researched the relationship between political campaigning and social media platforms. Bossetta discovered and outlined four types of digital media architecture in his study: network structure, algorithm filtering functionality, and datafication. This network structure helped narrow down the strategy for the content found on politicians' social media accounts (Bossetta, 2018). Bossetta mentions that these four categories affect the way citizens receive political messages. The structure, functionality, and algorithms help filter which potential voters are exposed. The following three social media platforms were compared to conclude the connectivity of these networks and how relevant they were to political campaigning. Snapchat had a limited form of utility for campaigns because of its many barriers. Snapchat is not as accessible for people to search for politicians' names as on Instagram, Facebook, or Twitter. Bossetta found that politicians are more inclined to use Facebook, Instagram and Twitter because of their targetability to the mass audiences. In 2016, Trump, Cruz, and Clinton's campaigns showed that Facebook was the social platform where the most content exposure occurred. It also shows that the rates of influence and exposure vary and fluctuate depending on the social media app.

The study Social Media Sites of Politicians Influence Their Perception by Constituents examined the impact of social media and how politicians are viewed through Facebook and Twitter (Hellweg, 2011). Social media can affect how constituents might view politicians. It's also a means to an end when influencing and engaging with potential voters.

In this study, Hellwag researched how the unique content of politicians can have a positive impact on voters because the content is perceived as trustworthy (Hellweg, 2011). One example of social media having a beneficial effect on campaigns is former President Barack Obama. Obama's strategy was to uplift the power of young voters and use the internet to his advantage. He had an undeniable victory towards the end of his presidential campaign, thanks to the activism of his supporters. Hellweg mentions that Obama was the first to implement this tactic, which resulted in a positive outcome with thousands of youths engaging online and promoting a social movement that assisted his campaign. Since Obama's success with creating a relationship of sorts with voters, many politicians have replicated his strategic internet use. They have used social media as a tactic to win over potential voters.

The 2016 U.S. presidential election also utilized Twitter as a platform for political campaigns. Gunn Enli (2017) researched the most used social media apps during election campaigns. In the published article, Twitter as an arena for the authentic outsider: exploring the social media campaigns of Trump and Clinton in the 2016 U.S. presidential election, they find that Twitter has become a strategy and the main form of communication for candidates. Both Trump and Clinton's campaign strategy was to connect with as many voters as possible through social media. The study mentions that Clinton's campaign had an authentic style because of the amateurism of the campaign's content (Enli, 2017). It was also found that when politicians seem relatable, it often leads to political persuasion; therefore, it becomes easier to influence voters, just like Obama did in 2008 (Nott, 2020).

Similarly, this translates into a level of trust that voters have in candidates. In Trust in the Age of Social Media: Populist Politicians Seem More Authentic, Enli and Rosenberg (2018) shed light on how media trust and political trust go hand in hand when it comes to voters determining whether a candidate is trustworthy. The younger generation believes that politicians are more honest and authentic on social media than on mainstream media. It was found that the more exposure to broadcast news and newspapers, the more trust is given to the press (Enli & Rosenberg, 2018). Individuals who often engage with the media gain more knowledge that keeps them trusting the media and political candidates. The higher the exposure to online news, the higher the chances of political trust (Enli & Rosenberg, 2018).

On the other hand, those who are not often politically engaged are the people that do not trust the media and often refuse to engage with online media (Norris, 2002). To gain trust, politicians must maintain credibility (Enli & Rosenberg, 2018). Authenticity has been one of the critical components of trustworthiness. Politicians usually change and adjust their image to appear more authentic or perfect in the eyes of the media. However, when a politician performs by speaking the truth and acting authentically, it provides a blueprint for their essential role as a politician (Enli & Rosenberg, 2018). Scholars have researched the engagement within the media and have discovered that political campaigns have been adapting to online social media, with the newest transition being the TikTok app.

Political Representation on TikTok

TikTok has been perceived as a lip-syncing and dancing app when in reality, it has become a multifaceted social media platform. It's a social media app that launched to fame

for its algorithm-driven feature that provides one-of-a-kind content (Anderson, 2020). TikTok is a unique app; it is about the user's creativity and how they combine sound and movement to create engaging and informative content. Tiktok is famous for making users feel comfortable expressing themself on this platform compared to social media apps like Instagram, where most content is photography. Users feel the freedom of creating any content on TikTok.

The unique factor that puts TikTok ahead of other social media apps is the lack of search function. TikTok is an app where users receive their content based on their interests. The algorithm system recommends videos based on previous videos that the user might like. The infamous "For You" page is how the app sends content to the user. Mostly, the app sends videos to the user's "For You" page based on the user's interests, hobbies, and previously liked videos.

During the past presidential election, TikTok content creators took on politically charged messages and informed their audience through 15 seconds to 1-minute videos about the presidential candidates running for office. These opinionated content creators uploaded videos on the different political parties. They inform, persuade, and encourage their viewers to vote. Most of the users on the app are young and actively express their political views and beliefs. Influencing other young voters may have had a significant impact on elections turnout. Popular accounts like @tiktokforbiden, @conservativehypehouse, @genzforchange, @typical_democrat, @matthew.rein, and many other TikTok pages have had some influence on young voters.

One example of the power and influence that TikTok holds is the event of 2020, where thousands of young TikTokers came together to request tickets to Donald Trump's rally in Tulsa, Oklahoma, with no intentions of attending. TikTok trolled on Trump's effort to rally after they humiliated him by requesting more than 1 million tickets for the event, and only 6,000 people showed up. For the leftist political TikTok, this was a rather satisfying victory (Rosenblatt, 2020).

The article, Dancing to the Partisan Beat: A First Analysis of Political Communication on TikTok focused on evaluating political communication on TikTok. This study collected data by scrolling through hundreds of videos and identifying specific political hashtags. Many of the video topics were related to social issues like abortion, religion, gun control, and the Second Amendment. This study concluded that TikTok is a "new form of political communication that creates, shares, and diffuses information" (Medina, 2020). Politicians from all over the world are joining TikTok after seeing its potential and the influence it can create. One country that has included TikTok content as part of its politician's social media strategy is Spain (Cervi & Lladó, 2021). Spaniard politicians have incorporated this app to establish relationships with their voters and grow their political popularity. They publicize videos that make them seem relatable and, overall, more trustworthy, which is one of the most used strategies in public relations (Cervi & Lladó, 2021).

In short, TikTok is an effective way to promote a campaign or candidate. Because the demographic of this app is younger users, the target during elections is to convince young voters to go out and make their vote count. As this social media app continues to grow and develop, TikTok should continue to be explored and studied in-depth to understand the impact it can have in future political campaigns. Therefore, I propose the following research questions:

RQ 1: How does TikTok influence public discourse?
RQ 2: In what ways did TikTok influence the 2020 presidential campaigns?

Method

TikTok is still a new social media platform compared to Facebook, Instagram, and Twitter, and there has been little to no research conducted on the political influence this app has. Other platforms have been studied to dissect the impact and discourse utilized in different social media. Because of the novelty of this social media platform and the influence I observed online during the 2020 presidential elections, I decided to use qualitative content analysis to research more in-depth how TikTok influences political communication and campaigns. Qualitative content analysis connects words and themes that make interpretation and generate possible meaning. It is the act of gathering data, analyzing and interpreting it. Some various methods and approaches can be made through qualitative content analysis. An inductive approach was taken to discover, develop, and analyze data for this research. Decontextualization, categorization and compilation are stages that also form part of the data analysis.

The data was collected between March 28, 2022, and April 3, 2022. I analyzed politics-related videos on TikTok for 1 hour two times a day, at 1 p.m. and 9 p.m., for seven days; I created a separate TikTok account specifically to collect data and conduct a content analysis on the right and left-leaning political videos filmed in 2020. Once the TikTok account was created, I went to the search section in the app. I looked up the most well-known and controversial statements that made content related to the presidential election between Trump and Biden. I let the algorithm do its job, and within minutes I had political-related videos featured on my "For You" page. Another feature I utilized while doing my research was using the filtered feature to search for videos explicitly created during the 2020 presidential election period. All data collected from these videos served as the primary form of analysis for my study.

The hashtags searches used were #2020, #presidentalelection, #leftist, #politics #Trump, #Biden, #rightpoliticalparty #convervative, #democrat and #republican. Most of the videos included at least one of the hashtags that had gone viral and had hundreds of thousands, sometimes millions of views and likes. I examined a total of 50 TikTok videos that contained information that I thought could influence voters with their details regarding a specific political candidate. Out of those 50 videos I saw, 23 were downloaded to my laptop's cloud. My data gathering ended on Sunday, March 3, 2022, and I did not download any more videos for this study. The reason for choosing to analyze 23 videos was to comprehend the influence these videos can have on the people consuming them. There were more videos from one side of the political party than the other, which also impacted the number of videos selected.

Results

Within the seven days of content analysis, the "For You" page began to push more content related to the @politicalcomandcampaigns account within the first three days. During the seven-day content analysis, I realized that if I liked videos from a specific political party, the more their videos would show up on the TikTok's page. For example, the TikTok account @genzforchange popped up a lot with videos related to the liberal side of the political spectrum. Most of the videos that I encountered on the "For You" page were about Donald Trump being a sexist, racist, and a supporter of white supremacy, among other videos. The same thing happened with the other political side; videos about Joe Biden were also negative from the Republican side. Videos about Biden being incompetent and having health issues were common themes. Out of the 23 videos initially seen, 11 were categorized as leftist and the other 12 were far-right.

A particularly interesting theme was the videos created by both sides of the political party and how these accounts used dark humor and personal attacks on the opposing presidential candidates. Videos mocking the opposition candidates and stating positive remarks for the other candidate were created for contrast. For example, Trump supporters constantly belittled and shamed Biden for his stuttering and forgetfulness. On the other hand, Biden's supporters do the same and offend Trump by picking on his hair and exaggerated tan. The tone of the videos was another aspect that was analyzed. As previously mentioned, both candidates were described in ways that benefited the other political candidate. The videos were created in an informal tone and involved some humor. How content creators convey their message seems personable, and it influences the response of the viewers, as seen in the comment sections of said videos. The word choices the creators chose used in videos against Trump were "sexist," "racist," "homophobic," and "supremacist," among other name callings that were implied the creators. Similarly, videos featuring Biden also had a different tone. He was perceived as a candidate that would bring peace. A candidate who was an advocate for women's rights and someone who would provide equality of opportunities for all. From my observation, I understood that the videos created were made to "attack" the opposite candidate. This social media was not a civil place to share information as it seemed to be very much "my views are the correct ones" or "this candidate must win…." Because of this, the videos create a one-sidedness that leads viewers only to believe one side of the political party.

The creators of the videos are young adults aiming their videos at a young population. Because of this, I believe the objective of the videos does indeed convince young adults to vote for a specific political party. If a person did not know much about politics and came across one of these videos, they are more likely to sway in the direction of that political party.

Discussion

This research provides insight as to how TikTok influences political campaigns and discourse. TikTok is a platform that enables anyone to become a creator and edit videos that share their political views with thousands, if not millions of people across the internet. TikTok is a social media app that uses a unique algorithm, and it makes it easier for content

creators' videos to become viral. The videos on this app are "liked bases," meaning that the content appears based on the type of videos previously liked. Because of this feature, TikTok's algorithms are problematic—people will only see videos based on what the algorithm thinks they will enjoy. This creates a one-sidedness that can lead to people becoming less informed, extremist, and radicalized toward one side of the political party. It also increases the chances of political polarization. It could provide opinions opposed to one party and will only increase that feeling and attitude over time.

The way that content creators make videos can have consequences on how users of TikTok view politics. Nowadays, young adults are not viewing the news as much as before. Instead, they receive their information from the internet and social media platforms like TikTok. Since TikTok has become a focal point for politics, it has become easier for this app and its creators to influence and convince viewers to believe one side of the political spectrum. TikTok is frequently used to spread information and ideas; whether they are true or not, it makes it complicated for many not to become politically polarized by the videos.

We need to take TikTok more seriously as it is a platform that has a lot of power—it's not what people think it still is—an app for kids to view funny videos. TikTok currently holds significant influence in the political world. These videos influence Americans to vote in elections, which will change our nation in the next few years. TikTok is creating an echo chamber that only repeats and amplifies the situation by creating a closed communication system that can soon make our country more politically polarized.

Conclusion

We live through times where social media has the power to create a split between political groups. The literature has provided insights into how it may amplify with other social media platforms. TikTok does indeed influence the political perspective of young adults. There is also a problem with the political videos because most, if not all, are created from the first-person point of view and are strongly biased, which maybe increase polarization in public discourse.

Because of the limited amount of time and resources, there were limitations to this study. Although there could have been other ways of approaching this research, it still allows the reader to understand the topic I and the problem with online activists and political influencers for both the political parties. TikTok's "For You page will become an asset and a tool used for political candidates soon. This platform has the potential to make just about anyone viral, and when it comes to politics and people's opinions and biases, that's where this app excels. This app's potential is massive, but the consequences are also alerting as polarization in America can increase even more and political influence can adversely affect the political environment.

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Writing Preferences Among Mandarin and English speakers: A Study on Linguistic Factors and Cultural Patterns of Rhetoric

Abstract

To what extent does language and culture influence writing styles? Prior literature on the intercultural characteristics of written discourse has drawn support from empirical studies on text, genre, and corpus analyses (Sapir, 1929; Kaplan, 1966; Connor, 2004; Belcher, 2014). Early research in intercultural rhetoric proposed distinct writing patterns across ethnolinguistic repertoires by categorizing writing styles along dual distinctions e.g. linear vs. non-linear, open vs. closed. As one of the most culturally diverse countries, scholars have emphasized the assimilation of writing customs and linguistic patterns among non-native English speakers within dynamic educational environments (Hofstede, 1980; Hinds et al., 1987; Connor, 2004; Sheng et al., 2014). - more digressive and inductive practices emphasizing figurative language, while native English speakers favor to hierarchically organize information. Although studies in intercultural rhetoric have evolved beyond these ethnolinguistic comparisons of written cultural and linguistic artifacts, fewer studies regarding the ethnolinguistic influences of writing are attributed to Mandarin-English bilinguals. The present study investigated the proposed differences in writing preferences between Mandarin-English bilinguals and English monolinguals at the discourse level. We anticipated that Mandarin-English bilinguals would rate non-linear paragraph structures higher, whereas English monolinguals would rank linear paragraph structures higher. These findings highlight prevailing paradigms surrounding written rhetorical features and intercultural communication emphasizing the discrepancies between linguistic and cultural styles that may contribute to misperceptions in meaning and writing orientations among interlocutors.

Introduction

Researchers have long been fascinated with the intersection between language, culture, and thought. Extensive studies on the Whorfian hypothesis supports that language experiences shape individual thought processes with observations on language-specific patterns in writing (Whorf, 1956; Kaplan, 1966; Connor, 2004). The five components of language defined by phonemes, morphemes, syntax, semantics, and pragmatics as language acquisition and common linguistic patterns are linked together by phonological, conceptual, and morpho-syntactic information that enable people to create meaningful communication. Furthermore, empirical studies have supported associations between language and mental representations that differs between linguistically and culturally different groups, such as Mandarin speakers with vertical spatiotemporal orientations and the Greeks conceptualizing the future as something approaching from behind (Boroditsky, 2001; Maul, 2008; Lai & Boroditsky, 2013). These insights on language learning and representations have placed contrastive rhetoric into the ethnolinguistic corpus on writing orientations, structures, and function. Cross-linguistic research underscores the manifestation of universal language commonalities, while highlighting the dissimilarities and similarities of concepts even among the culturally and geographically isolated (Pinker & Jackendoff, 2009; Jackendoff, 2009).

Contemporary writing systems like Mandarin Chinese have evolved into logographic characters from its pictorial underpinnings while the American English alphabetic system descended from the West Germanic languages. Visual elements are manifested with concrete writing and figurative devices in perceptual explorations of language, as these graphic representations offer valuable insights towards cultural orientations considering the strong writing traditions of Chinese and English (Tversky, Kugelmass, & Winter, 1991; Tomasello et al., 2005). Cross-linguistic differences encoded in these devices can highlight rich details surrounding cultural manifestations of writing styles and language, as studies on intercultural rhetoric, formerly known as contrastive rhetoric, underlines divergent writing habits between Mandarin and English speakers (Kaplan, 1966; Lakoff & Johnson, 1980; Mio, 1997). In resonating with the universal attributes of language, investigations of larger cultural wholes are examined in written and oral communication (Müller, 2009).

Contextual influences of linguistic and cultural repertoires in writing assumed in the discourse patterns of English, Semitic, Romance, and Asian language groups were previously characterized as linear, parallel, and digressive communication forms. In Kaplan's seminal 1966 analysis of native and non-Native English learner's writing in the classroom, discernible differences were observed in the organization and descriptions of their compositions. Various scholars echo that English speakers stressed the necessity of framing ideas with salient topic sentences, while the Mandarin speakers tended to be more obscure and abstract in their writing (Connor, 2002; Erbaugh, 1990). However, these dichotomies have since been criticized for lacking cross-cultural empirical support, as non-native English speakers could present "linear" arguments just as well as native English speakers in writing (Hinds, 1990; Belcher, 2014). These critiques accuse intercultural rhetoric for endorsing "ethnocentric" values by attaching binary categories to language (Hinds, 1987; Connor, 2002). However, the rationale behind intercultural rhetoric asserts that these properties are intended to lessen "mechanistic" approaches regarding the pedagogical frictions with cultural variations in the classroom, particularly in the evaluations of non-native English speakers (Kaplan, 1966; Hinds, 1990; Belcher, 2014).

In Western cultures, which are generally defined as societies influenced by Hellenistic philosophy, the historical dimensions of culture and language have continuously evolved toreflect perceptions and values grounded in the pragmatic and theoretical. Although viewed as less intellectually rigorous and critically opposed to Socratic thinking, an enormous global population belongs to the Eastern cultures where Confucianism, Daoism, and Legalism substantially shaped contemporary cultural principles (Li, 2003; Shi-xi, 2007). Post-imperial China denounced Confucianist views embodied in Chinese society as the central cause for China's backwardness in its resistance to the modernization promoted by Western ideas (Chow, 2013). Nonetheless, Confucian principles are vigorously incorporated in Eastern cultures with the adoption of foreign values, while the United States has been increasingly pressured to assimilate principles from Eastern cultures to address experiences of citizens from non-Western cultures (Zhilin, 1989; Biggs, 1996).

For instance, Asian students may be perceived as more passive learners in superficially engaging with material in the US (Pratt, Kelly, & Wong, 1999; Barker et al.,

1991). Although Asian students consistently outperform other groups in America, the Eastern philosophy of Confucian-heritage countries is typically framed as a mystical and abstract resource antithetical to the Socratic thinking expected in the classroom, despite their success (Kwok & Lytton, 1996; Tweed & Lehman, 2002; Li, 2003). Although these philosophical, linguistic, and cultural asymmetries visibly emerge in written discourse, many remain unaware of the discrepancies in cultural writing practices by discounting the historical underpinnings of Eastern cultures despite mirroring the same values of education (Baker, 1997).

This has nurtured pedagogical research on intercultural methods for teaching English as a second language (ESL) students, as intercultural rhetoric has broad implications for teachers and students navigating cross-cultural settings in the classroom and beyond (Tversky et al., 1991; Lieven, 1994; Connor, 2004; Baker, 2008). Attempts to create emic frameworks with moreglobally minded perspectives in intercultural rhetoric address how culturally self-evident concepts regarding fundamental aspects of human experience may lack linguistic definitions in other cultures (Connor, 2007; Shi-xu, 2007). Although Kaplan's notion of contrastive rhetoric has foregrounded teaching and interpretations of writing to English as a second language (ESL) learners, various challenges remain in adequately strengthening notions of linguistic expressions, compositions, and communications in text, corpus, and genre analyses (Mao, 2003; Connor, 2004; Belcher, 2014). Identifying language patterns based on national culture is perhaps irrelevantly broad given the inherent heterogeneity, but there are sufficient contrasts in cultural values and orientations that support the clarifications from intercultural rhetoric to emphasize the writer's process and reader's interpretations, instead of being caricatured as arbitrary linguistic and cultural manifestations (Hofstede, 1980).

This study examined the linear and non-linear preferences of Mandarin-English bilinguals and English monolinguals to assess the extent of cultural and linguistic influences in written discourse. Subjects read six prompts and twenty-four pre-written paragraphs (twelve linear and twelve non-linear passages) to rank how effectively each one was presented. We predicted that Mandarin-English bilinguals would prefer the linear paragraphs, while English monolinguals would prefer the non-linear paragraphs.

Methods

Eighty-seven undergraduate students were recruited for this study through Cal Poly Pomona's Sona Systems. After excluding participant data due to insufficient survey progress, sixty-seven were included in the final data analysis, with twenty-two Mandarin-English bilinguals and forty-five English monolinguals.

Those who indicated proficiency in Mandarin completed a one-item translation test by selecting the correct translation of a sentence in Mandarin. Six short essay topics and twenty-four corresponding passages were administered through an online Qualtrics survey, which was entitled "Rating Persuasive Arguments". Each topic was consecutively presented to participants, which included two linear and two nonlinear passages. Topics covered wildlife conservation, fake news, animal testing, universal healthcare, climate change, and the minimum drinking age (Appendix A). After reading each passage, participants indicated

how effectively each paragraph was written on a 7-point Likert scale from (1) extremely ineffective to (7) extremely effective. They were debriefed at the end of the survey that the study's true intent was to assess their writing preferences.

Results

A between-subjects 2x2 mixed factors ANOVA test was conducted to examine the interaction between rhetoric (levels: linear, nonlinear) and language (levels: Mandarin, English) between Mandarin-English bilinguals and English monolinguals. More women (43%) took this survey with the mean age being 22 years old. After the final analysis was conducted in SPSS 26, there was no statistical significance in the interaction between rhetorical preference and language; $F(1, 65) = 3.778$, $p = 0.73$.

Figure 1. Bar graph showing the mean effectiveness ratings of linear and nonlinear passages for Mandarin-English bilinguals and English monolinguals.
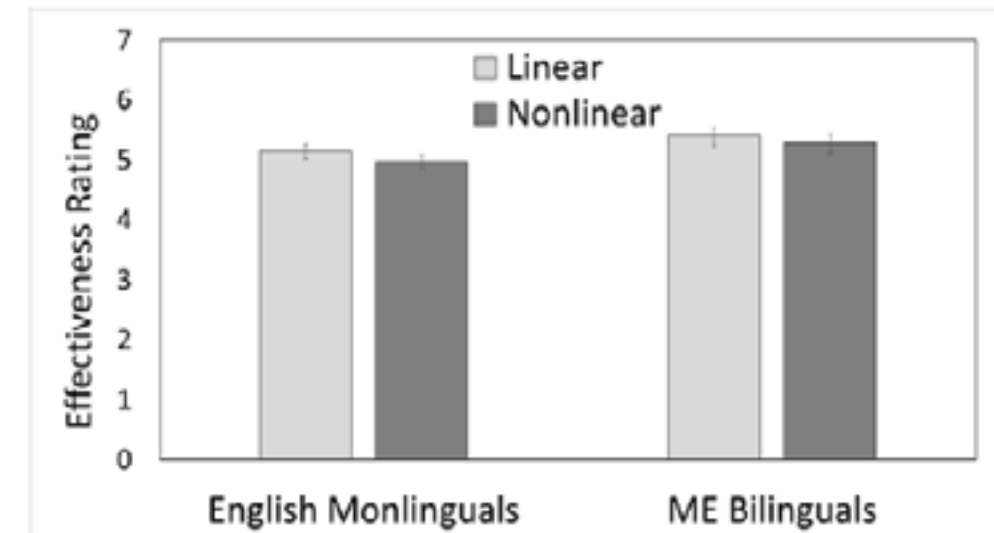
Discussion

This study did not find support for the hypothesis that rhetorical preferences among Mandarin-English bilinguals and English monolinguals were different. Unsurprisingly, there was more difficulty recruiting Mandarin-English bilinguals at the university, which was why participants were not required to identify with Asian racial/ethnic backgrounds to be eligible. A subsequent study would greatly benefit with this adjustment in addition to recruiting more participants. Moreover, the construction of the stimuli and integration of linear and non-linear elements could be modified and improved if working with linear and nonlinear categories. Moreover, as cross-cultural research suggests certain cultural elements cannot be transmitted through language, which is why it could be useful to replicate this study in Mandarin Chinese with Mandarin monolinguals (Everett, 2005; Sheng, Lu, & Gollan, 2014).

A past cross-linguistic study investigating the oral descriptions between Mandarin Chinese and English speakers similarly found no discrepancies in their verbal organization when asking them to describe a short video with of a man picking pears (Erbaugh, 1990). Although Erbaugh noticed Chinese speakers were more likely to emphasize the manner

of pear picking, these narrative descriptions reflect the absence of divergent preferences towards discursive orientations. While this further dissipates generalizations about Western and Eastern cultures, this complicates the existing research on intercultural rhetoric regarding the ethnolinguistic paradigms and methods of written discourse. Considering how both studies were conducted in English, priming effects may have inclined Mandarin-English bilinguals towards linear dimensions (Tooley & Traxley, 2010). Moreover, these projects were administered in the US, as geographic location could influence participant responses in addition to completing the study in English (Rentfrow, & Jokela, 2016).

Future studies can focus on analyzing participant-generated writing styles to identify linguistic and discursive patterns towards developing more conclusive concepts framing ethnolinguistic differences. Furthermore, a historical cross-cultural analysis and comparison of texts is needed to better grasp the ethnolinguistic underpinnings of contemporary language in culturally diverse societies akin to the US. Additional research can further conceptualize and examine these distinctions across contexts in personal, academic, and professional discourse by incorporating different quantitative and qualitative methodologies, such as interviews and ethnographic approaches. Moreover, intercultural rhetoric can also examine unaddressed differences between traditional and computer-aided writing and reading in an era of digital literacy (Hartley, 1991; Matsuda & Atkinson, 2008; Belcher, 2014).

The binary orientations of writing used for this study were not intended to demonstrate that linear styles were more rational as stressed in prior research, but to emphasize how ethnolinguistic backgrounds could induce partiality towards linguistic traits in writing in consideration of how context-dependent settings impact discourse. Furthermore, linear and nonlinear concepts are not diametrically opposed to each other, as Mandarin and English clearly contain homogenous linguistic and cultural features. However, it is within these distinctions that discursive nuances can be found in combination with individual exceptions e.g. language and cultural familiarity.

While language and culture are powerful agents in human perceptions, representations, and interpretations, not all is strictly confined to these dimensions, as these human aspects are distributed in physical embodiments (Lashley, 1951). As language is a vital extension of the individual and collective, there are a multitude of idiosyncratic differences in the evaluation of culture and writing orientations presenting challenges to these schematic categories, with the framework of linearity used in this study having been supplanted by evolving incarnations of writing. However, these distinctions can be helpful rather than oversimplistic for the development of more compelling concepts and methods in intercultural rhetoric research.

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Appendix A

Topic 1: Fake news

Do you believe that fake news on social media is problematic? Why or why not?

A. Main idea - Fake news is a problematic issue because of the misinformation it presents on social media platforms.

1. Fake news renders it difficult to differentiate authentic information from misleading content.

2. Because of the immediate availability of online information, fake news can take precedence over authentic news as sensational headlines often attract misplaced attention.

3. Misleading information can give rise to serious consequences, like influencing voters and public sentiments.

4. Rebuttal: Eliminating fake news from social media platforms is virtually impossible - it is the audience who should have better skills for discerning false information from authentic content.

5. Social media outlets and sources should be held accountable for misinformation on their platforms, which they can resolve by filtering content better and directly addressing it on public grounds.

Passage 1a:

I argue that fake news on social media poses a serious issue with the rapid spread of misinformation. Firstly, fake news has become increasingly difficult for users to differentiate from actual information. Furthermore, the open access of fake news with social media has resulted in misleading information to take importance over authentic news at times, as

sensational headlines can make the public more apt to quickly popularize and spread the misinformation. Thirdly, this misleading information can lead to significant consequences such as influencing political beliefs and votes for candidates. While some argue that it is impossible to entirely eliminate fake news and highlight that audiences should learn to better discern authentic sources from false information, I reply to this objection by arguing that all social media outlets and their sources are ethically obligated to present news as truthfully as possible by monitoring and tagging misinformation, even if the audience can learn to filter through false information.

Passage 2a:

Fake news has become notably widespread with the age of social media, many examples of which can be found on nearly every media outlet as questionable or outright misleading sources are used. There are many ways that fake news can be spread, especially with the accessibility of online information on social media, as it can emerge from personal or business accounts. Furthermore, misinformation can fester inaccurate assumptions that influence political voters. While some argue that detecting fake news is the audience's responsibility as misinformation multiplies too quickly, we have the technology today that renders the battle against misinformation more feasible with AI technology to tag fake news. Although we may be able to inform the public of better ways to discern inauthentic sources, we can consider alternate and more effective ways with technology on social media platforms to address this sea of misinformation.

B. Main idea: Fake news is not as problematic on social media platforms in comparison to advertising given the distortions that are often covertly present.

1. Fake news is usually quickly identifiable and social media outlets have been tagging misleading information to notify the audience.

2. The number of advertisements the average person is exposed to on a daily basis is astounding compared to fake news.

3. Major news outlets remain popular sources for information in comparison to social media platforms, which are generally reliable.

4. Rebuttal: Advertisements can be ignored more easily than fake news since the latter is often marketed as authentic - also, there are greater filtering capabilities targeting ads.

5. Advertising still emphasizes serious issues with subliminal messages present in ads that can contribute to harmful long-term distortions.

Passage 1b:

Compared to the subliminal issues that stem from advertising, fake news on social media is considerably less problematic. Fake news is often quickly identified and marked as an untruthful source on the social media stage, compared to ads that masquerade with deceptive information that is often overlooked in their importance, despite the average person's daily exposure to an enormous number of ads. Additionally, advertisements may have more powerful effects on beliefs and behaviors than fake news on social media platforms, as social media users tend to attend to non-news content as traditional outlets such as CNN and Fox News are still considered the primary sources for news. Although some argue that advertisements can be easily ignored in comparison to fake news with ad blockers, subliminal advertising can present a more serious issue than fake news since they are usually dismissed as harmless. Although advertising and fake news may be considered equally harmful because they are both marketed based on their

authenticity, advertising characterizes a much larger issue than fake news with the rapid spread of subliminal messages on social media.

Passage 2b:

Fake news is considerably less problematic in comparison to the negative impacts of advertising on social media. While fake news is often quickly identified as misinformation, misleading advertisements are typically overlooked due to fewer filtering systems on social media. Furthermore, the sheer amount of ads a person is exposed to daily is comparably higher in comparison to fake news. Although fake news is also present on social media, traditional media outlets are still highly regarded as news sources in comparison to social media outlets. While ads can be managed with greater ease in comparison to fake news, advertisements remain a prevailing problem that potentially exacerbate harmful beliefs and attitudes through subliminal messages.

Topic 2: Climate change

Do you believe the United States federal government should enforce policies for environmental sustainability?

C. Main Idea: The U.S. government is not responsible for enforcing environmentally sustainable practices.

1. Past government efforts to conserve resources have been somewhat successful, such as the Environmental Protection Agency's Clean Air Act of 1963 and the National Environmental Policy Act of 1970 - however, climate issues continue mounting amidst all these legislations.

2. Businesses and individuals are personally obligated to practice eco-friendly means and should not be forced to.

3. Eventually, consumer choices will force businesses to make sustainable choices, or business itself will be forced to make changes with their own incentives.

4. Rebuttal: Businesses and individuals have been successfully held accountable for their choices and actions through legislation in the past, because without them, climate change would more than likely be an even greater issue.

5. Conclusion: Even though businesses and individuals can be forced to abide by legislations and policies, there are still plenty of loopholes that have been circumvented.

Passage 1c:

It is not the federal government's responsibility to promote environmental sustainability, as prior efforts in the U.S. have extensively attempted to ameliorate environmental impacts with minimal success. Past government legislations have not been effective in changing the course of climate change, as emission rates and temperatures remain abnormal across the globe. Instead, businesses should be individually obligated to adopt eco-friendly practices, as their business interests will eventually lead them to make choices resonating with the public sentiment. Furthermore, consumer choices will eventually force businesses to choose more climate friendly options given the renewed public emphasis on environmental sustainability. Although proponents for government interventions argue that businesses cannot be relied on to adjust their models due to appeals from internal or consumer pressures, enforcing federal laws will not significantly improve environmental sustainability given the multitude of factors beyond intervening that affect climate change.

Passage 2c:

Since the 1900's, the US has continuously grappled with legislation on climate change. These conversations have led to further discussion on the appropriate methods for preventing further environmental damage and led to the enactment of various legislations. Nonetheless, these assumptions have led to lasting policy changes such as the Paris Climate Accord and Environmental Protection Act in addition to a slew of other legislations promoting environmentally friendly practices. However, these government interventions have been invisible as environmental changes have reshaped the globe as man-made and natural disasters continue mounting. Those in favor of government interventions highlight that these legislations have minimized the environmental impact of businesses, as environmental issues would likely be exacerbated without them. Although these legislations target large corporations, they continue to find windows of opportunity in loopholes by outsourcing their operations.

D. Main Idea: The U.S. can improve climate change through additional legislation and the promotion of sustainable practices.

   1. Past government efforts to conserve resources have been somewhat successful, such as the Environmental Protection Agency's Clean Air Act of 1963 and the National Environmental Policy Act of 1970.

   2. As major corporations are the largest culprits behind environmental impacts, legislation should be designed to curb their emissions.

   3. Businesses should have government incentives to select sustainable choices that benefit, which would decrease costs in the future.

   4. Rebuttal: Despite past policies and government efforts, climate change remains a prevailing issue.

   5. Conclusion: Without government intervention, it is more than likely climate issues would be exacerbated.

Passage 1d:

Since the Industrial Revolution, the U.S. government has grown increasingly concerned with environmental conservation efforts as the Clean Air Act of 1963 and National Environmental Policy Act of 1970 were enacted. These past government efforts to conserve resources have somewhat diminished environmental damages as major corporations are the largest culprits behind environmental impacts. Moreover, providing government incentives for businesses to make sustainable choices will address the environmental turmoil caused by climate change. However, some argue that past policies and government efforts have improved little, as climate change remains a prevailing issue. Despite this, it is more than likely environmental damages would be exacerbated without government intervention.

Passage 2d:

Federal interventions would be beneficial for the promotion of sustainable practices, as past government efforts to conserve resources have been somewhat successful (e.g. the Environmental Protection Agency's Clean Air Act of 1963 and the National Environmental Policy Act of 1970). As large corporations often generate the highest emissions and environmental impacts, legislation could mandate these businesses to minimize their emissions. Moreover, businesses should have government incentives to make sustainable choices, which would decrease the economic costs of climate change in the long-term. With this, proponents against government interventions argue that these legislations have done little to offset climate change. However, without these past government efforts, it is more than likely climate change would be more severe in the present.

Topic 3: Healthcare

Should universal healthcare be implemented in the United States? Why or why not?

E. Main Idea: Universal healthcare is a human right in many countries that supports the health needs of the public.

1. Universal healthcare should be considered a given right for people to access health care.

2. Governments can provide the necessary funds for some sort of universal healthcare that supports basic needs at the minimum.

3. Those who are uninsured with chronic and acute conditions eventually add to the economic costs.

4. Rebuttal: However, those against universal healthcare argue that these frameworks are unfeasible because there is no single framework that effectively works at each government level.

5. There are plenty of options including single-payer systems that can help alleviate the economic strain in support of universal healthcare.

Passage 1e:

Universal healthcare has been considered a human right in many countries; however, other countries like the U.S. primarily have health care systems that are unaffiliated with the federal government. Proponents for universal health care argue that healthcare is a necessity for all people as their right to dignity and alleviating suffering because the government has the necessary resources to provide basic health services. Those who are uninsured with chronic conditions become financially shackled by accumulating financial burdens and economic costs overall. Despite this, those against universal healthcare argue that there is no system that could

sufficiently serve the health needs of the entire nation. However, there are a variety of choices including different payer systems that may help alleviate the costs of universal healthcare.

Passage 2e:

Universal healthcare in the United States would be beneficial for the public, as many international countries implement similar programs as a human right. Healthcare should be accessible for anyone who should not be restricted based on their health history, identity, class, and economic status. Additionally, the federal government has the necessary funds and resources to implement basic universal healthcare across state and local levels, as those uninsured with chronic health conditions eventually incur even greater financial costs. Despite this, some argue that the economic costs and healthcare infrastructure are not feasible. However, providing necessary healthcare would address the long-term costs arising from chronic health issues by improving the living conditions and health behaviors of citizens. Establishing universal healthcare would alleviate health concerns and economic burdens, with the option of incorporating different payer systems to operationalize the healthcare system.

F. Main Idea: The costs and inefficiencies of universal healthcare outweighs available through other insurance plans.

1. Organizing these efforts at the federal, state, and local level would be tremendously difficult.

2. There is too much diversity to generate a single plan to serve all health needs in the population.

3. There are plenty of other options with the mixed-market system in the U.S. that still serves the health needs of the public.

4. Rebuttal: Proponents of universal healthcare argue that the advantages of alleviating chronic illnesses are beneficial for the economy and nation in the long-term.

5. However, implementing universal healthcare in the U.S. would be emphasized by system inefficiencies undermining the efficacy of healthcare.

Passage 1f:

Implementing universal healthcare is infeasible due to the cost of resources needed for implementation, which also increases the likelihood that the system will be too overwhelmed to serve the public's health needs. Implementing these efforts at each federal, state, and local level would be tremendously difficult due to various individual, social, and economic factors. The sheer diversity within a population makes it too difficult to generate a single plan to serve all health needs in the population. Furthermore, there are a multitude of options available in the mixed-market system that provide viable options to address the health needs of the public. However, those in favor of universal healthcare argue that improving chronic conditions and other health issues are advantageous for the economy in the long-term. Nevertheless, a basic universal healthcare program in the U.S. would still be undermined by system inefficiencies.

Passage 2f:

While universal healthcare could serve the public's health needs, the extent of coverage and implementation needed makes it difficult to achieve such goals at each government level. The diverse pool of individuals makes it exceedingly difficult to create a universal health care plan to remedy the needs of the general public. As the mixed-market system in the U.S. already has a wide variety of health care options, a holistic healthcare program would not be necessary. Although supporters of universal healthcare highlight the economic costs of chronic health

conditions among the uninsured, efficacy in healthcare would be debilitated by the insufficient infrastructures with a universal healthcare system.

Topic 4: Animal Testing

Do you believe that animal testing should be banned? Why or why not?

G. Main Idea: Animal testing should not be banned because these tests are still provide relevant insights into human biology and conditions.

1. Animal testing is not inevitably lethal or dangerous to the animal, despite criticisms of unnecessary harm.

2. Animals still serve as sufficient models for human health insights, thus remaining reliable for research.

3. Rebuttals: Critics of animal testing argue that animal testing does not provide relevant insight into biomedical research.

4. Animal testing should still remain an option as not all experiments are misleading or incompatible with human biology and benefit biomedical research.

Passage 1g:

Despite criticisms of animal testing in biomedical research who typically focus on the harm caused to animals, these experiments offer relevant and salient insights in biomedical research. At the epicenter of most arguments against testing is that animals are harmed in the process; however, animal testing is not always dangerous or fatal for the animal. Furthermore, animals can still illustrate biological conditions and physiological processes for biomedical research. Despite this, some argue that animal testing provides faulty and unreliable data on human

biology. However, animal tests can still detail substantial insights on human biology and benefit biomedical research.

Passage 2g:

Animal testing should not be prohibited as these experiments still offer relevant insight into human biology and health conditions. While most arguments address the harm caused to animals, testing is not inevitably lethal or dangerous to the animal. Moreover, animals can still be sufficient biological models for biomedical research according to research. However, critics of animal testing also argue that animal testing does not provide relevant or reliable insights on human biology. Although there are instances where animals are incompatible with human biology, animal tests can still offer substantial insights on human biology and benefit biomedical research.

H. Main Idea: Animal testing for biomedical purposes should be banned as they are not effective at providing information on human biology.

1. Studies show that animals are insufficient models for revealing human conditions due to various biological variables.

2. These testing procedures on animals are irrelevant to humans, as there is new technology for guiding biomedical research.

3. These ineffective procedures are also costly and often severely harm the animals.

4. Rebuttal: Other studies argue that biological similarities in health conditions between animals and humans make them effective models for assessing diseases and medical procedures.

5. Animal testing for human health should still be banned given the harm it causes animals, as they are unnecessary for validating biomedical research on human conditions.

Passage 1h:

Biomedical sciences no longer benefit from animal testing, as these tests do not provide reliable information on human biology. Research has shown that animals are improper models for human conditions given the biological variables. Moreover, there is new technology surpassing the procedures conducted on animals in validity and reliability, as these ineffective procedures are costly and can severely harm the animals. While some argue that biological similarities in health conditions between animals and humans bear substantial similarities for assessing diseases and medical procedures, animal testing for human health should still be banned given the harm it causes animals along without yielding relevant data on human biology.

Passage 2h:

Animal testing has been an invaluable resource to biomedical research in the past - however, these experiments are no longer the most effective at informing human biology. Studies have demonstrated that animals are non-sufficient models for testing specimens, which renders many experiments in biomedical research unreliable. While proponents supporting animal testing argue that there are sufficient biological similarities between animals and humans, there have been newer technologies devised that are more cost-efficient and accurate. Furthermore, animal testing often seriously harm the animals without providing relevant or accurate insights into biomedical research.

Topic 5: Minimum Age for Alcohol Consumption

Should the minimum drinking age be lowered in the U.S? Why or why not?

I. Main Idea: The minimum drinking age should not be lowered in the U.S. due to biological and social factors that impact one's functioning.

1. Driving safety issues with alcohol impaired driving and other alcohol-related incidents.

2. Binge drinking is commonly noted among adolescents, which can damage brain functioning and work performance.

3. Rebuttal: Arguments for lowering the minimum drinking age suggest there are benefits, as these regulations tend to do more harm than good by increasing stigma around drinking.

4. However, even with lowering the minimum drinking age, there are still negative outcomes surrounding underage drinking which may increase as a result.

5. Lowering the drinking age will not address underage drinking, as it has been linked to alcohol dependence and other risk factors.

Passage 1i:

The minimum drinking age in the U.S. should be maintained, as there are a host of biological and social factors that may harm underage drinkers. Driving accidents and other alcohol-related incidents would likely remain the same or increase with a lowered minimum age. Furthermore, binge drinking is commonly noted among adolescents, which can hinder brain functioning and work performance. While proponents for lowering the minimum drinking age argue these regulations do more harm than good by unnecessarily stigmatizing alcohol, there are risks with unintentionally increasing underage drinking. Therefore, lowering the drinking age likely will not decrease underage drinking, which has been further as it has been linked to alcohol dependence and other risk factors.

Passage 2i:

For many adolescents, risk-taking behaviors like underage drinking is part of growing up. One resounding concern with lowering the drinking age in the U.S. are the effects of alcohol on one's biological and social functioning that causes ripple effects. Intoxicated driving is a serious issue in addition to other alcohol-related incidents from underage drinking. Binge drinking is also common among adolescents, which can lead to decreased functioning and work performance in one's juvenescence. Despite this, arguments for lowering the drinking age propose that destigmatizing underage drinking will decrease the number of incidences. However, there remains the health risk of inadvertently increasing underage drinking by decreasing the minimum age. Lowering the drinking age will not address this public health issue, as underage drinking can metamorphose into alcohol dependence and other alcohol-related incidents.

J. Main Idea: The minimum drinking age should be lowered to 18 in the U.S., as underage drinking rates remain high and legal repercussions can impede safer consumption.

1. There have been past legislations targeting underage drinking, but alcohol-related incidents still remain high among the underaged.

2. Legal consequences do not prevent underage drinking from happening and may result in underaged individuals becoming fearful of reporting alcohol-related incidents.

3. Rebuttal: Arguments against lowering the minimum drinking age comment on safety hazards and biological effects of heightened underage drinking.

    0. E.g. brain development

4. However, despite past laws attempting to address the matter of underage alcohol consumption, it remains a prevailing and stigmatized issue that accumulates economic costs.

5. Lowering the drinking age would help mitigate the legal consequences surrounding

    underage drinking and alcohol-related incidents.

Passage 1j:

The drinking age in the U.S. should be lowered to age 18, as laws targeting underage

drinking remain ineffective. With alcohol-related incidents, underage drinkers may be fearful of

reporting accidents due to legal consequences. Moreover, past legislations targeting underage

drinking have insignificantly improved the number of alcohol-related incidents for the

underaged, as legal consequences do not prevent these incidents from happening. Instead,

underage drinkers may become fearful of reporting alcohol-related incidents due to legal

repercussions. Arguments against lowering the minimum drinking age highlight the safety

hazards and biological effects of heightened underage drinking. However, despite past laws

attempting to minimize underage drinking, alcohol consumption remains a prevailing and

stigmatized issue among the youth which also incurs economic costs. Lowering the drinking age

would help mitigate the legal consequences surrounding underage drinking and alcohol-related

incidents and create a space for further dialogue.

Passage 2j:

For the youth, there are many influences that promote underage drinking. As past legislations

regulating underage drinking have minimally worked, lowering the minimum drinking age can

promote safer consumption among the youth, as dangerous and fatal accidents saturated by the

influence of alcohol may be exacerbated by the fear of legal consequences. Those who argue

against a decreased minimum drinking age emphasize the safety hazards and biological effects of

underage drinking on brain development. However, past laws have substantially decreased

underage drinking issues, and have only accumulated additional economic costs. Easing legal

mandates on the minimum drinking age can help address alcohol-related incidents by

encouraging safer consumption among the youth.

Topic 6: Wildlife conservation

Do you believe that zoos benefit wildlife conservation efforts? Why or why not?

K. Main Idea: Zoos assist with wildlife conservation efforts by promoting biodiversity and

preserving species.

1. Zoos remain a safe haven for wildlife, as caretakers do their best to promote the

    wellbeing of their species.

2. Visitors help financially provide these animals a place to reside and funds other wildlife

    expeditions.

3. Zoos are known to help preserve endangered species, whose habitats may have been

    destroyed.

4. Rebuttal: Proponents against zoos argue that they detract from the funding and efforts of

    wildlife sanctuaries that protect a greater amount of endangered species.

5. Zoos are still important spaces for protecting species from environments that have been

    threatened and help educate the public about environmental issues.

Passage 1k:

I defend that zoos remain important to conservation efforts as spaces promoting and protecting

biodiversity. Zoos are still safe havens for wildlife by protecting species. Additionally, zoos are

important spaces for people to learn about wildlife they would likely never have contact with on

a regular basis. Furthermore, zoos support endangered species in this way by providing them a

space to thrive and for scientists to observe them out of harm's way. However, those that are

against zoos argue that there are various unethical practices that harm animals more than they benefit them. Despite this, the large-scale efforts of zoos remain an important way of educating the public about issues surrounding wildlife and help protect species from habitats that have been threatened by climate change and other impacts.

Passage 2k:

Zoos offer critical insight into the lives of animals that allow for unobtrusive observations for the public and for scientists. Although it may seem unethical to entrap animals, species like the red panda and tiger have become endangered with habitat destruction. While some believe that zoos fail to adequately support wildlife in comparison to other conservation efforts who are based on site, zoos offer large-scale efforts that educate the public about wildlife species and environmental issues while protecting them to a greater degree.

L. Main Idea: Zoos hinder wildlife conservation efforts because they do not adequately support organizations solely dedicated to the sustainment of wildlife.

1. Zoos are often centered around profit, not on protecting endangered species.

2. There are wildlife organizations that have a more direct impact on wildlife conservation efforts than zoos do, as they are often onsite.

3. Keeping wild animals in captivity for display is unethical, as other wildlife conservation efforts typically focus on reinstating them.

4. Rebuttal: Those who support zoos argue that they are unique spaces that help educate the public about environmental issues and protect species.

5. There are other impactful ways to educate the public as other conservation efforts are often more effective at caring for them.

Passage 1l:

Although there are zoos that harbor animals in safety, these spaces often become detrimental by diverting efforts away from other wildlife organizations that are more effective in preserving and protecting species. In comparison, wildlife organizations outside of zoos prioritize the well-being of animals over potential profit. In prolonged captivity, animals can suffer from losing touch with their original habitats in zoos, while wildlife organizations are often assisting species onsite. Even though zoos may illuminate current environmental issues impacting the wildlife, organizations centered around wildlife conservation are often more effective at nurturing species and promoting biodiversity in their habitats.

Passage 2l:

Zoos obstruct the efforts of wildlife conservation organizations by detracting from the resources needed, efforts solely dedicated to wildlife conservation. Zoos are centered around generating profit, often to the detriment of the animals in captivity and endangered wildlife species that need protection. Moreover, animals kept in zoos are intended for display, rather than the reinstatement of species back into their original habitats. While those who support the efforts of zoos argue that they provide the necessary space to protect certain wildlife species and educate the public on conservation efforts, there are more impactful ways to educate the public on preserving species than entrapping them in institutions designed to gain profit.

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Analysis of Endurance Horses Eliminated During the Tevis Cup 160-km Ride from 2016-2019 and 2021

Abstract

Endurance riding is a competitive sport where horses ride over long distances, 120-160 km, in the fastest possible time. Endurance riding is challenging not only for the physical and mental endurance but also the range of climate, terrain, and elevation. During the ride, handlers and veterinary staff are on-site, at various points on the trail, to check on the horse's health. Horses are pulled at these vet checks for reasons such as metabolic and lameness issues. Because athletes are pushing their horses to their limit, clinical research on the sport has increased concern for the wellness of the horse. Today's modern-day endurance ride, the Tevis Cup, began in 1955 and consists of a 160-km ride in 24 hours from Truckee to Auburn, CA. This present study is an extension of previous research which examined risk factors preventing completion of the Tevis Cup from 1997 – 2004. Specifically, I am analyzing the factors contributing to non-completion rates for horses in the Tevis Cup from 2016 - 2021. The percentages of non-finishers from 2016 - 2021 were: 42.27%, 46.51%, 57.04%, 46.73%, and 52.63%, respectively (P = 0.99). This suggests that the non-completion rates for the Tevis Cup have stayed consistent during this time cycle of the ride. There were no statistical differences in the age of horses (P = 0.55). There was a statistical difference in breed: Arabians and Arabian cross-breeds were the majority of the horses, mostly due to possessing higher endurance and stamina abilities. As for sex, geldings are pulled the most from the ride because geldings are the majority of the horse population. The first Tevis Cup ride consisted of only five riders. The number of riders has increased over time with the highest number in 1987 of 271 entries and data from this current study average 160 riders for the 5-year span. This trend reflects that the equine endurance sport has grown in popularity and despite this growth, elimination rates of the Tevis Cup have still stayed consistent.

Major objective(s)

My major objective was to learn how to process and analyze the data. I completed data collection and data analysis during the spring semester. I collected my findings into a presentation and prepped for RSCA and the McNair Symposium. I will begin to prepare for the next College of Ag's RSCA Showcase on Friday, May 6, 2022.

Background research with analysis and summary of literature review:

Endurance riding is a competitive sport where athletes train with their personal horses to ride them over long distances, 120-160 km, in the fastest possible time (Nagy et al., 2012). The trails for endurance riding are challenging not only for

the physical and mental endurance but for the range of climate, terrain, and elevation. Because athletes are pushing themselves and their horses to their limit, clinical research on the sport has increased concern for the wellness of the horse and the rider (Nagy et al., 2012). Today's modern-day endurance ride, the Tevis Cup, began in 1955 and consists of a 160-km ride in one day from Truckee to Auburn, California. There are several risk factors associated with elimination rates but the two most common causes are metabolic reasons and lameness. Other factors include high temperature and humidity as a cause of exhaustion or a reduction in running speed (Adamu et al., 2014). Pain across the withers or back also contributed to elimination due to lameness (Nagy et al., 2012). Breed also played a factor in elimination rates among several studies, breeds native to North American horses such as the Quarter Horse, Tennessee Walking Horse, and Rocky Mountain Horse (Nagy et al., 2012). Additionally, shorter distance rides presented higher completion rates (Nagy et al., 2012). Risk of musculoskeletal injuries is also higher in longer-distance rides. In competitions, Arabian horses and Arabian crossbreeds make up the majority of the completion and of the riding population. Generally, at lower distance rides there is greater diversity in other breeds such as Cobs, Thoroughbreds, Sports Horse breeds, and Shires (Nagy et al., 2012). Arabian horses and crossbreeds have particularly high stamina and endurance abilities (Schroeder et al.).

Methods (Experimental procedure/design):

Variable	Label
Year	Year Riding Season
Cases	Pulled Horses
Pull Code	Reason for Failure
Pull Location	Place Where Horse was Pulled Including Distance Traveled
Sex	Sex of Horse: Mare, Stallion, Gelding
Breed	Breed of Horse: Arabian, Arabian-cross, etc.

Age	Age of Horse
Horse Kilometers	Overall Kilometers Completed by the Horse within the Riding Season
Horse Rides	All Rides Attempted by the Horse within the Riding Season
H 160 Starts	160-Kilometer Rides Attempted/Started by the Horse within the Riding Season
H 160	Completed 160-Kilometer Rides Completed by the Horse within the Riding Season

| Jarrin Luis | **A Cross-Cultural Model of Systemic Trust and Reasoning about Truth** |

Summary

In this research we aim to get a cross-cultural perspective about how people's sociopolitical beliefs, judgments of risk, and attitudes towards commerce are related to how they reason about what's real and what's not. Our target audience are workers in public policy, researchers in psychology, marketing, political science, economics. We hope our results help public officials figure out useful ways to increase public trust and fight misinformation. We also expect our work will be appealing to journalists and hence the general public as well. Our research speaks to several issues important to our times (misinformation, institutions, attitudes towards inequality). This research will bring new understanding to understanding the consequences of misinformation, how people reason about inequalities, the importance of having trustworthy political and economic institutions, and how people react to crises like the COVID-19 pandemic.

We will also make important contributions to social science literatures including social psychology, political science, and marketing. Prior research on misinformation has tend to be siloed within disciplines, focused mostly on American samples, and lacked a cohesive theoretical framework, all issues we address in our research.

Our current data reinforced our "Red Cell" thinking concept, which means that lack of differentiation between authored and discovered reality, is associated with intolerance for ambiguity, intuitive thinking, social and institutional trust among others. "Red cell" thinking in turn increases belief in misinformation, justification of social inequalities, and symbolic thinking. These results have held up in the United States, Canada, New Zealand, Germany, China, France, Russia, and Ecuador.

Studying countries that partake in other political, economic, and cultural backgrounds will help us to contrast their data with people residing in a more democratic-capitalistic ideology. Our purpose is to uncover new facts about public behavior and its relationships with different social factors.

Introduction

Even prior to the start of the Covid-19 pandemic, social science researchers expressed concerns about living in the "post-truth" era defined by the spread of misinformation, fractured institutional trust, and an attack on the idea of reality itself (Lewandowsky, Ecker, & Cook, 2017). National security experts stressed that misinformation was not just spread among citizens; rather, some political actors use misinformation to sow discord, eradicate confidence in a working democratic system, and scapegoat marginalized groups (Paul & Matthews, 2016; Pomerantsev & Weiss, 2014; Waltzman, 2017). The pandemic threw new coals on the already burning fire, with researchers studying the spread of and harm done by Covid-related misinformation (e.g., Bursztyn et al., 2020, Rutjens, van der Linden, van der Lee, 2020; Kim et al., 2020; Roozenbeek et al., 2020). The flow of misinformation is thus a matter of both individual reasoning and structural causes.

In this project our goal is to develop and test a comprehensive framework that identifies how reasoning about reality relates to sociopolitical beliefs. We hope this project serves public policy experts and social science researchers from several fields, namely social psychology, political science, and marketing. One of the emerging duties for social scientists during the pandemic has been documenting and explaining theoretically what has been going on, and we aim to make a novel contribution to those efforts both by introducing our framework and testing it in several countries. Here we present the ideas behind our framework and the results of survey data collected thus far in the United States, New Zealand, and Canada. We hope to expand our data collection to other countries in Phase 4 of Projects Hatchery.

Background & Motivation

As researchers documented the spread of "fake" news (e.g., Vosoughi, Roy & Aral, 2018) they have also started to disentangle why people are willing to believe or share misinformation. Echoing earlier views that intuitive thinking causes false beliefs to spread (e.g, Boudry, Blancke, & Pigliucci, 2015), cognitive deficits (Pennycook & Rand, 2020) and political motivation (Finkel et al., 2020) have emerged as independent causes, suggesting that belief in misinformation can only partially be explained by lack of information or lack of knowledge of normative rules of reasoning. These partial explanations leave open the possibility that people have idiosyncratic beliefs about how they sort through what is real and what is not, though research has yet to directly address this.

Concurrently, other researchers have identified authoritarian thinking, particularly right- wing authoritarianism, as a contributor to belief in misinformation. Authoritarian personality (meaning extreme obedience to authority realized through subordination of marginalized people) is strongly related to belief in misinformation (Richey, 2017; Goldberg & Richey, 2020) with being "close-minded" (meaning a tendency to not update beliefs in light of new information) identified as one potential mechanism (Sinclair, Stanley, & Sell, 2020).

These insights fit with security experts who suggest authoritarian regimes can weaponize disinformation. For example, several experts have noted that the Kremlin in Russia deliberately – and openly – spreads misinformation to attack the very idea of the truth itself and draw attention to the government's ability to create such an attack (Paul & Matthews, 2016; Pomerantsev & Weiss, 2014; Waltzman, 2017). Echoing this, former Trump campaign strategist Steve Bannon infamously – and, again, openly – stated that their media strategy was to "flood the [media] zone with shit", intentionally (and, again, openly) spreading misinformation in order to destroy the credibility of the press (Illing, 2020). Not coincidentally, this misinformation tends to work against the marginalized who have the most legitimate claims against such regimes, often recasting them as scapegoats (Edelman, 1988).

Our central motivation here was to create a new reasoning style construct that incorporates all of these insights from disparate fields, and to create and test across cultures a framework of its antecedents and consequences.

Framework

The center of our framework is our measurement of what we call "Red Cell" thinking, to our knowledge the first thinking style scale that quantifies people's beliefs about the nature of reality. Our framework assumes people can think of what's correct as something that's "discovered" – there's a right or wrong answer that can be found or verified against some standard, but they can also think of truth as "authored" – what's "correct" is created by interpretation without any standard that can legitimize one perspective over another. People might think one way of viewing truth is more appropriate for some things than others – for example, people might think how light bulbs work is a subject for which what's correct is entirely "discovered" and individuals can have perspectives that are clearly incorrect, while people view the subject of how funny a particular movie is as "authored" entirely by perspective and no perspective could really be incorrect. One of our hypotheses is that people are least susceptible to misinformation when they are maximally discriminating between these two ways of thinking – they think of empirical issues (e.g., physical science) as much more discovered than authored, and they think of personal judgments (e.g., taste) as much more authored than discovered.

At the other extreme, and most susceptible to misinformation, is what we call "Red Cell" thinking, wherein people do not discriminate between "discovered" and "authored" truths, seeing all ways of getting at correctness as just as viable. The term refers to the "Red Cell" of the CIA that was critical in producing "evidence" that the Bush Administration used to justification the 2000s Iraq War. The Red Cell members were instructed to deliberately ignore what the facts directly suggested about the potential threat of Iraq and instead lean into the idea that intelligence can support any course of action if one looks hard enough, creating "possibilistic" scenarios of Iraq's possession of weapons of mass destruction that paradoxically acted within officials' minds as evidence supporting the war while they knew it was not true (Draper, 2020).

In this sense the evidence was both "authored" in that it was created by the Red Cell but also "discovered" in that it was treated as information that made the war seem like the correct decision. So we use the term "Red Cell thinking" to refer to a reasoning style wherein for all types of issues (e.g., empirical issues but also personal taste judgments) people think what's "correct" can be both authored or discovered, without really discriminating between the two. Additionally, the greater one's tendency towards Red Cell thinking, the more susceptible one is towards misinformation, but also the more one inclined is to authoritarian thinking (e.g. thinking the world is rightly divided into social classes, blind respect for authority, endorsing marginalization of certain social groups).

We use structural equation modeling (SEM) on the data collected from the survey described in this paper to test the following antecedents and consequences of Red Cell thinking:

Antecedents

1) Intuitive thinking – One straightforward prediction is tending to base decisions on more intuitive as opposed to deliberative thoughts leads to Red Cell thinking, since Red Cell thinkers likely over-weight intuitions when they confront contradictory facts.

2) Authoritarian personality – Based on the above-cited work suggesting that the goal of authoritarian governing is often to attack the idea of truth itself, we suggest that having an authoritarian personality will be linked to Red Cell thinking.

3) Intolerance for ambiguity – Tolerance for ambiguity captures the tendency to see ambiguous situations as either threatening or desirable. We predict that being more intolerant of ambiguity will lead to a greater tendency towards Red Cell thinking (even though Red Cell thinking implies an ambiguity about what is true and what is not), since intolerance for ambiguity is itself associated with authoritarian thinking (Jost, 2017), and intolerance for ambiguity should lead people to lean away from complexity in how they think about reality, social reality or otherwise.

4) Social trust – Building on the above, authoritarian efforts often seek to undermine societal trust and harmony in order to shift trust towards the government, so we predict that social trust – particularly trust in outgroups – will be negatively correlated with Red Cell thinking.

5) Trust in institutions – We propose that institutional trust shapes Red Cell thinking, however we remain open to the direction of the relationship and propose it might differ by country. On the one hand, some political scientists (e.g,. Acemoglu & Robinson, 2012) take it as a given that institutional trust is a fundamental resource for productive, well-informed citizenry, which would seem to imply that more trust should be associated with less Red Cell thinking. However, other work shows that citizens of democratic nations lower in trust are the ones most motivated to change it (Cichocka, Aleksandra & Górska, 2017), and, as cited above, governmental trust can come at the expense of social harmony. Thus we remain open to the relationship working in both directions.

Consequences

1) Belief in misinformation – Represented here as belief in Covid-19-related misinformation, this straightforward prediction is based on the idea that Red Cell thinking is likely to be associated with legitimizing any available perspective, including misinformation.

2) Social dominance orientation – Defined as the tendency to justify existing inequalities (Pratto et al., 1994), we predict that Red Cell thinking engenders SDO thinking by making it easier to see such justifications as legitimate.

3) Symbolic thinking – Building on ideas from political science that politicians often used symbolism in place of factual argumentation (Edelman, 1988), we predict that Red Cell thinking will be associated with being sensitive to the symbolic meaning of actions, particularly symbolism involving power. We measure this both in a Covid-19 context, looking at perceptions that taking preventative measures makes people look symbolically weak, and

also a consumer context, looking at preferences for products that can show off prestige and status.

4) Perception of Covid-19 danger – Falling out of the idea that Red Cell thinking is associated with misinformation and thinking of efforts to combat Covid-19 as symbolically negative, we further predict that Red Cell thinking will be negatively correlated with Covid-19 risk perception.

Importantly, this is one way of modeling the antecedents and consequences of Red Cell thinking and we do not claim it is the only causal pathway. Most likely, the causal pathways proposed here are bi-directional (e.g., authoritarian thinking engenders misinformation which in turn reinforces authoritarian thinking), but the model proposed here is a straightforward way of modeling how thinking about how institutional factors shapes how people reason, which in turn shapes susceptibility to misinformation.

Methods

Participants and procedure

We surveyed people in the United States (N = 1095), New Zealand (N = 485), Canada (N = 497), Germany (N = 493), China (N = 494), France (N = 499), Russia (N = 498), and Ecuador (N = 502). Surveys were translated for countries where the most common language is not English (i.e. all except the US, New Zealand, and Canada). To qualify do the entire survey, respondents needed to pass an initial attention check asking them to state the current year, as well as an attention check embedded in the first screen of questions (the Red Cell questionnaire) asking them to pick "Strongly agree" and "Strongly disagree" on two specified items. To qualify for analysis, respondents also had to pass two other attention checks asking them to pick out specific scale points at two different points during the survey. Data analyses were only done on this subset of participants. Data collection was managed by Cint, who provided nationally representative samples of each country based on gender, age and ethnicity. The survey was programmed in Qualtrics and took about 15 minutes to complete.

Measures

Red Cell Questionnaire. Respondents begin by filling out the Red Cell thinking style questionnaire. This instrument consists of 15 different "issues" divided into three categories, with five issues per category. The categories are personal opinions (e.g., how good a cup of coffee is), social science issues (e.g., whether economic equality is increasing or decreasing), and physical science issues (e.g., how light bulbs work). Respondents rated agreement on a 9-point scale with two items for each of the 15 issues, those being the "authored" item ("For this issue what is "correct" is created by perspective or interpretation,") and the "discovered" item ("For this issue there is a correct answer that can be found or verified.") The full set of issues and the instructions shown to respondents are in Appendix A.

Following this, respondents filled out scales measuring our predictors and outcomes of Red Cell thinking. Scales are organized into predictors and outcomes below but were displayed to respondents in random order. Text of all scales is in Appendix A.

Predictors included the Social Dominance Orientation scale (Pratto et al., 1994), Feelings Are Truth scale of intuitive thinking (Stein, Swan & Sarraf, 2020), ANES authoritarianism scale (Hetherington & Suhay, 2011), tolerance for ambiguity scale (Budner, 1963), societal scale that included measures of trust in ingroups, outgroups, institutions, and science, (Dryhurst et al., 2020). Trust in institutions was also measured with an original scale created by authors measuring perception of availability of several types of socioeconomic resources (e.g., health care, education, ability to start a business).

Outcomes included the Covid-19 misinformation belief scale (Roozenbeck et al., 2020), Covid-19 symbolism scale created by the authors measuring perceived symbolic threats caused by Covid-19 (e.g. "Wearing a mask is a sign of weakness"), brand symbolism scale (adapted from Bhat & Reddy, 1998), and perception of Covid-19 danger and fairness of regulations (adapted from Makhanova & Shepherd, 2020 and Roozenbeck et al,. 2020).

Following these scales, respondents completed measures of basic demographic information and ideology, including a categorical measure (choices were Liberal, Conservative, Libertarian, Other, None, and Prefer not to say), and continuous measure sof social and economic ideology (1 = Very Conservative to 9 = Very Liberal).

Results

Scale reliabilities for all metrics split by country are in Table 1.

Table 1. Scale reliability, by country

	US	NZ	CA	DE	CN	FR	RU	EC
Red Cell scale								
Overall scale	.91	.85	.87	.89	.66	.85	.86	.84
Subscales								
Social science	.73	.74	.73	.91	.82	.82	.74	.83
Physical science	.94	.93	.93	.8	.79	.95	.93	.81
Personal opinions	.89	.88	.89	.94	.9	.80	.87	.91
Predictors								
Authoritarianism	.63	.64	.58	.44	.19	.56	.52	.5
Tolerance for Ambiguity	.46	.57	.44	.45	.33	.62	.58	.14
Feelings are truth	.83	.85	.85	.83	.72	.82	.77	.78
Perception of resource availability	.90	.84	.86	.87	.85	.88	.88	.81
Ingroup trust	.71	.67	.68	.7	.67	.66	.62	.63
Outgroup trust	.74	.77	.69	.83	.74	.84	.69	.78
Science trust	.85	.84	.86	.75	.77	.84	.78	.55
Institution trust	.85	.81	.86	.9	.79	.83	.87	.74
Outcomes								
Covid-19 Symbolism	.83	.82	.81	.84	.85	.77	.72	.72
Social Dominance Orientation	.82	.78	.80	.64	.41	.78	.65	.58
Covid Misinformation Belief	.78	.78	.81	.77	.81	.71	.68	.68
Covid-19 worry	.92	.88	.89	.92	.86	.92	.88	.83
Covid-19 danger perception	.77	.79	.84	.76	.71	.63	.83	.39
Brand Prestige	.84	.84	.83	.8	.73	.80	.78	.73
Brand Expression	.78	.78	.79	.73	.7	.72	.77	.5

Country codes: US = United States, NZ = New Zealand, CA = Canada, DE = Germany, CN = China, FR = France, RU = Russia, EC = Ecuador

Red Cell scale. The Red Cell scale is scored by first computing the difference between the "discovered" and "authored" item for each issue, thus creating a single score for each issue that measures how strongly the respondent discriminates between the two ways of thinking about reality for each issue.

These 15 difference scores were then subjected to a hierarchical CFA using the lavaan R package (Rosseel 2012), grouped by country. The first level of the CFA tested a three-factor structure corresponding to each type of "issue", thus testing that the personal opinion, social science, and physical science items can be treated as subscales. The second layer includes one factor consisting of each of the three subscales, thus acting as single measure of "Red Cell" thinking.

The model overall shows good fit (RMSEA = .05, CFI = .98), supporting that the Red Cell items can be either indexed into subscales and averaged into one overall scale. Importantly, the CFA model shows that, across countries, the personal judgment scores covary negatively with the other subscales, with the covariance between personal judgments and physical science subscales being especially high. Thus, as predicted, rather than there being universal tendencies to see reality as ether wholly discoverable or authored, those who see scientific issues as more discovered than authored tend to think the opposite for personal opinions, thus being "discerning" in how they view the nature of reality.

Index scores were created for each subscale. For use in the regressions reported below we also created one overall score comprising all 15 items, with the personal opinion difference scores reversed, since that subscale is negatively correlated with the others.

Means of each difference score, subscale, and the overall score are in Table 2. As might be expected, respondents have a strong preference for thinking that what's "correct" for personal opinion items is more authored than discovered, while also having a strong preference for thinking what's "correct" for the physical science items is more discovered than authored. Respondents also tended to think that what is "correct" for the social science items is more discovered than authored, though this preference was not as strong as for the physical science items.

Table 2. Mean and standard deviations of Red Cell scores and subscales by country. For the sub-scales, positive numbers indicate a preference for "discovered" reality than "authored", while negative numbers indicate the opposite. Overall scores consist of the average of the social science, physical science, and reverse-scored personal opinion scores such that higher scores indicate greater preference for discovered reality for the science items and authored reality for the personal opinions.

	United States Mean	United States SD	Canada Mean	Canada SD	New Zealand Mean	New Zealand SD	Total Mean	Total SD
Overall Red Cell scale	3.15	2.62	2.79	2.51	2.60	2.37	2.36	2.55
Subscales								
Personal opinions	-3.82	3.42	-3.28	3.13	-3.16	3.17	-2.57	3.52
Social science	1.35	2.79	1.20	2.68	0.88	2.62	1.05	2.91
Physical Science	4.33	3.61	3.92	3.56	3.80	3.56	3.48	3.80

	Germany Mean	Germany SD	China Mean	China SD	France Mean	France SD
Overall Red Cell scale	2.22	2.61	.65	1.38	1.84	2.28
Subscales	-2.66	3.45	.43	2.61	-1.39	3.05
Personal opinions	.82	3.04	.90	2.40	1.08	3.11
Social science	3.21	3.95	1.49	2.77	3.06	4.06
Physical Science	-2.66	3.45	.43	2.61	-1.39	3.05

	Russia Mean	Russia SD	Ecuador Mean	Ecuador SD
Overall Red Cell scale	2.26	2.47	1.40	2.56
Subscales				
Personal opinions	-2.50	3.40	-1.51	3.38
Social science	.83	2.97	.59	3.48
Physical Science	3.45	3.82	2.20	4.20

Scores on the "Red Cell" scale can thus be interpreted as follows: those on the low end of the scale tend to strongly think reality for personal opinions is more a matter of perspective than something that can be discovered, while reality for scientific questions is more something that can be discovered rather than something that is a matter of perspective. Those on the high end of the scale tend to think reality is about equally a matter of perspective and something that can be discovered, respective of whether the question is personal opinion or scientific.

Other scales. Two subscales were computed from the Brand Symbolism scale, the brand prestige and brand expression subscales. The "Trust in Groups" scale was divided into four subscales, ingroup trust, outgroup trust, science trust, and institution trust (see Appendix A). All other scales were averaged into single indices.

Regression analyses. We first present a regression model with the overall Red Cell scale as dependent variable and the set of predictors – authoritarianism, Tolerance for Ambiguity, Feelings Are Truth, social and economic ideology, ingroup trust, outgroup trust, trust in science, trust in institutions, and perceived availability of resources as independent variables. We ran a regression for each model and for all three countries pooled, with dummy variables for Canada and New Zealand included as covariates.

The full results of each regression are in Table 3. In the regression ran on the three countries together, significant effects obtained for all predictors excepted social ideology, economic ideology, and perceived availability of resources. Thus, ideological splits on Red Cell thinking are statistically explained by the other predictors included in these models.

Table 3. Standardized regression coefficients from regressions predicting Red Cell scores, by country. Significant effects are in bold.

	US	NZ	CA	DE	CN	FR	RU	EC	Total
Authoritarianism	**-.16**	-.18	**-.21**	**-.22**	**-.21**	**-.16**	**-.18**	**-.14**	**.16**
Tolerance for Ambiguity	**.10**	.14	.03	**.13**	.03	**.19**	**.18**	.08	**.11**
Feelings Are Truth	**-.18**	-.25	**-.26**	**-.20**	**-.26**	**-.18**	**-.15**	**-.22**	**-.19**
Social ideology (Higher = more liberal)	.05	-.03	.11	.02	.11	-.08	-.12	-.04	-.01
Economic ideology (Higher = more liberal)	-.02	.07	**.16**	-.01	**.16**	.00	.07	.01	.00
Outgroup trust	.05	.17	.02	-.03	.02	.07	.03	.06	**.06**
Institutional trust	**-.23**	**-.20**	-.10	-.11	-.10	-.06	**-.15**	.02	**-.14**
Trust in science	**.19**	**.25**	.02	.08	.02	.10	**.15**	**.09**	**.13**
Ingroup trust	**.07**	.01	.07	.07	.07	-.07	-.03	-.01	.02
Perception of resource availability	-.01	-.02	.05	.02	.05	.08	-.04	-.05	.01
New Zealand dummy coding									**-.06**
Canada dummy coding									**-.04**
Germany dummy coding									**-.11**
China dummy coding									**-.26**
France dummy coding									**-.15**
Russia dummy coding									**-.10**
Ecuador dummy coding									**-.22**

Overall, then, good support was found for each predictor except for availability of resources, with authoritarianism, Feelings Are Truth, and institutional trust having the largest effects. Red Cell thinking is associated with more authoritarian attitudes, more trust in intuitive thought, more trust in institutions, but less social trust and trust in science. Interestingly, then, the relationship between trust and Red Cell thinking in these countries is that social trust decreases, and institutional trust increased Red Cell thinking, highlighting the need for additional data and theory on this issue.

Next, we ran a series of regressions with the full set of predictions from the previous models and the Red Cell scale and independent variables, and two of our key outcomes – Covid-19 symbolic thinking and Covid-19 misinformation. One regression per outcome and per country was run, as well as set of regressions on all three countries pooled together. The full set of results is in Table 4.

Table 4. Standardized regression coefficients predicting each outcome variable from the full set of predictors. Significant effects are in bold.

	US	NZ	CA	DE	CN	FR	RU	EC	Total
Outcome: Covid-19 symbolism									
Authoritarianism	-.03	.14	**.14**	.06	**.10**	.03	-.03	.01	.03
Tolerance for Ambiguity	-.05	-.05	-.05	-.06	-.01	-.03	-.05	-.02	-.05
Feelings Are Truth	**.06**	.07	.07	**.17**	.29	**.25**	**.21**	.06	.15
Social ideology (Higher = more liberal)	**-.12**	.04	.04	.02	.08	.10	**.12**	-.07	-.01
Economic ideology (Higher = more liberal)	**-.09**	-.01	-.01	-.08	-.06	-.07	-.05	.09	**-.06**
Outgroup trust	**.08**	.09	.09	.11	**.23**	.09	.05	.07	**.12**
Institutional trust	-.02	-.09	-.09	**-.15**	.07	-.06	**-.15**	.01	**-.13**
Trust in science	**-.33**	-.21	**-.21**	-.29	-.20	-.24	**-.11**	-.12	**-.25**
Ingroup trust	.02	-.02	-.02	.06	**-.13**	.01	.02	-.06	.01
Perception of resource availability	**.12**	.06	.06	-.08	-.14	-.05	**-.13**	.04	.02
New Zealand dummy coding									-.05
Canada dummy coding									.01
Germany dummy coding									.01
China dummy coding									**.04**
France dummy coding									**-.02**
Russia dummy coding									**.07**
Ecuador dummy coding									**-.08**
Red Cell Scale	**-.10**	-.22	**-.22**	-.20	**-.12**	**-.14**	**-.18**	**-.19**	**-.17**
	US	NZ	CA	DE	CN	FR	RU	EC	**Total**
Outcome: Covid-19 Misinformation beliefs									
Authoritarianism	.04	.06	**.12**	.05	.07	.02	.01	.08	.03

Tolerance for Ambiguity	-.03	-.06	-.08	-.07	.02	-.03	-.04	-.03	**-.05**
Feelings Are Truth	**.12**	**.15**	**.16**	**.20**	**.28**	**.27**	**.27**	**.23**	**.15**
Social ideology (Higher = more liberal)	**-.09**	-.02	.07	-.04	.05	.00	-.04	.02	-.01
Economic ideology (Higher = more liberal)	.01	.01	.01	.04	-.02	-.04	.07	-.01	**-.06**
Outgroup trust	**.06**	.05	-.02	**.13**	**.20**	.05	.00	.02	**.12**
Institutional trust	**.10**	.03	-.01	-.05	.09	-.01	-.08	-.01	**-.13**
Trust in science	**-.30**	**-.39**	**-.28**	**-.28**	**-.16**	**-.23**	**-.11**	-.10	**-.25**
Ingroup trust	.01	-.03	.08	-.02	-.08	.03	.07	.04	.01
Perception of resource availability	.13	-.01	.00	**-.13**	-.08	-.05	.06	.06	.02
New Zealand dummy coding									-.05
Canada dummy coding									.01
Red Cell Scale	**-.20**	**-.17**	**-.21**	**-.19**	-.05	**-.15**	**-.18**	**-.17**	**-.17**

Looking at the regressions across all countries, the Red Cell scale was a significant predictor of all outcomes except for concern about Covid-19 restrictions, with the Red Cell scale being having either the largest or second-largest effect for each outcome except perceived Covid worry.

Thus, these regressions provide strong support for the Red Cell scale being a robust predictor of important outcomes that has incremental validity over other measures of thinking style.

Structural Equation Modeling. We used the lavaan package in R to run a Structural Equation Model that tested that the Red Cell scale would be predicted by authoritarianism, Tolerance for Ambiguity, Feelings Are Truth, social ideology, economic ideology, perceived availability of resources, and trust of outgroups, ingroups, science, and institutions. Additionally, the Red Cell scale was tested as a predictor of Covid-19 misinformation, Covid-19 symbolism, brand expression, and perceived danger of Covid-19. Within the SEM, the Red Cell scale itself was approximated as a latent variable using the CFA structure specified above (i.e. this SEM extended the previous CFA with predictors and outcomes of the Red Cell scale). As with the CFA, this SEM was grouped by country.

Overall the model showed good fit, RMSEA = .05, CFI = .94. Looking at predictors of the Red Cell scale, results largely mirror the regressions, though ingroup trust was not a significant predictor in any country. The Red Cell scale was a significant predictor of most tested outcomes in each country.

Discussion & Conclusion

Results from countries we have gathered data in so far strongly support our hypotheses. "Red Cell" thinking, meaning a lack of differentiation between authored and discovered reality, is associated with intolerance for ambiguity, intuitive thinking, authoritarian thinking, and social and institutional trust. "Red cell" thinking in turn shapes belief in misinformation, symbolic thinking, belief in social hierarchies, and pro-brand beliefs.

These results offer the following novel contributions to social science literatures, including social psychology, consumer behavior, and political science:

- Creating and providing preliminary evidence for a framework that ties together decades of work on reasoning with contemporary issues of belief in misinformation and thinking about social justice, especially linking together threads of thought from political science (e.g., Edelman, 1989) suggesting that authoritarian thinking, particularly when it comes to demonizing outgroups, can be a means of attacking the idea of reality itself, opening the door for misinformation.

- Providing a new operational definition for a thinking style (Red Cell thinking) that leads to belief in misinformation, built on the face-valid observation that misinformation belief should be fed by having loose beliefs about what is an effective way of telling truth from falsity (Andersen, 2017). Further, the idea of Red Cell thinking acts as a "glue" for holding together otherwise disparate constructs related to reasoning and sociopolitical

beliefs.

- Demonstrating that unilaterally believing in "objectivity" is not associated with protection from misinformation; rather, selectively applying objectivity and subjectivity is least associated with belief in misinformation.

- Showing how reasoning style relates to brand preferences, specifically showing how Red Cell/intuitive thinking is associated with a stronger preference for using brands to show off symbolic identity. While not necessarily a negative (as opposed to belief in misinformation) this finding does help illuminate the characteristics of Red Cell-style thinking (i.e. focused on symbolism).

To the extent that the potential spread of authoritarianism and misinformation are worldwide issues, our contributions listed above are limited insofar as the hypotheses have been tested in a subset of countries. Cross-cultural generalizability has been a major issue in the last decade of social science research (Henrich, Heine, & Norenzayan, 2010),

Collecting data in other countries will also allow us to study country-level properties that might not appear at individual-level analyses, such as looking at if country-level differences in Red Cell thinking are mediated by differences in institutional trust. Additionally, the finding that Red Cell thinking is associated with decreased institutional trust seemingly contradicts conventional wisdom that more trust is optimal (e.g., cite something). However the countries we collected data on so far are (relatively) liberal democracies, where more liberal-leaning citizens are generally less susceptible to misinformation while also wanting bold government reform (cite something). This finding could reverse in countries with governments that more deliberately use misinformation as a show of power, in which case increased trust of institutions would be associated with Red Cell thinking.

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Appendix. Full text of survey instruments used.

Scale 1: Red Cell

For some issues, there are correct and incorrect answers that can be found or verified. But, for other issues, different people may reach different conclusions. For instance, you may have a different interpretation of a movie's meaning or message than someone else, and you might say that both perspectives are correct. Other issues might seem in-between – there might be some standard of judgment that's relevant to the issue, but also people can create their own meaning from their perspective. Please consider each issue below and rate the two subsequent statements. (1 = *Strongly disagree*, 9 = *Strongly agree*)

1. For this issue what is "correct" is created by perspective or interpretation.
2. For this issue there is a correct answer that can be found or verified.

- How funny a movie is
- How good a cup of coffee is
- Which of the past five decades had the best music
- Whether a slice of cake is too sweet
- Whether it's better to hold weddings in the afternoon or the evening
- Why the Great Depression happened
- Whether economic equality is increasing or decreasing
- The causes of unemployment
- The causes of World War I
- Whether using cell phones has an adverse effect on physical health
- Why yeast causes bread to rise
- How light bulbs work
- Whether a certain chemical is an effective paint thinner
- Why fog forms
- Whether a plant needs direct sunlight to survive
- So we know you're not a bot, for this one please answer with the first button ("Strongly disagree") for the first item and the last button ("Strongly agree") on the second item.

Scale 2: Social Dominance Orientation (Pratto et al., 1994)

Please rate the extent to which you agree with each of the following statements. (1 = *Strongly Disagree*, 9 = *Strongly Agree*)

1. An ideal society requires some groups to be on top and others to be on the bottom.
2. Some groups of people are simply inferior to other groups.
3. No one group should dominate in society.
4. Groups at the bottom are just as deserving as groups at the top.
5. Group equality should not be our primary goal.
6. It is unjust to try to make groups equal.
7. We should do what we can to equalize conditions for different groups.
8. We should work to give all groups an equal chance to succeed.
9. To ensure that you're not a bot, please select the first button ("Strongly disagree") on this question.

Scale 3: Feelings Are Truth (Stein, Swan & Sarraf, 2020)

Please rate the extent to which you agree with each of the following statements. (1 = *Strongly Disagree*, 9 = *Strongly Agree*)

1. People know, deep down, what's true and what's not.
2. Some people have intuitive senses of what is true and what is not.
3. A gut belief that something is not true is a good reason to think it's not true.
4. Intuition can reveal more truth about a situation than objective facts.
5. Gut feelings are a kind of truth.
6. To ensure that you're not a bot, please select the last button ("Strongly agree") on this question.

Scale 4: Covid Misinformation (Roozenbeck et al., 2020)

How accurate do you think each of the following statements about the coronavirus are? (1 = *Very inaccurate*, 9 = *Very accurate*)

1. The coronavirus was bioengineered in a military lab in Wuhan.
2. Being able to hold your breath for 10 seconds or more without coughing or discomfort is a good self-check test for whether you have the coronavirus
3. The coronavirus is part of a global effort to enforce mandatory vaccination.
4. Gargling salt water or lemon juice reduces the risk of infection from Coronavirus
5. The new 5G network makes people more susceptible to the virus
6. Breathing in hot air through your mouth and nose (e.g. from a hair dryer) kills the coronavirus as it can only live in cool places.
7. People with diabetes are at high risk of complications from coronavirus infection.
8. Using hand sanitizer with at least 60% alcohol is effective in reducing risk of infection from coronavirus.
9. Taking ibuprofen when you are infected with the coronavirus could make your symptoms worse.

Scale 5: Covid symbolism (original creation)

To what extent do you agree with the following statements about coronavirus-related restrictions and guidelines? (1 = *Strongly Disagree*, 9 = *Strongly Agree*)

1. By imposing restrictions that limit what businesses can be open during the pandemic, we are letting the virus win.
2. Wearing a mask is a sign of weakness.
3. Having gatherings that violate social distancing guidelines is a way of asserting freedom.
4. Continuous coronavirus coverage in the media has been a sign that we are losing.
5. Following coronavirus prevention guidelines means you have backed down.

Scale 6: Brand symbolism/practicality (based on Bhat & Reddy, 1998)

When you purchase things like food and clothing, how important is it to you that the products you buy have each of the following attributes? (1 = *Not at all important*, 9 = *Extremely Important*)

1) Practicality
2) The product makes you seem down-to-earth
3) Elegance
4) Prestige
5) Excitement
6) Distinctiveness
7) The product makes a statement
8) The product expresses your personality
9) The product can be a status symbol

(NOTE: "Brand prestige" corresponds to items 3 through 6, "brand symbolism" corresponds to items 7 through 9)

Scale 7: Authoritarianism (Hetherington & Suhay, 2011)

Although there are a number of qualities that people feel that children should have, every person thinks that some are more important than others. Below is a set of pairs of desirable qualities. Please note which one you think is more important for a child to have:

1) Independence or respect for elders
2) Curiosity or good manners
3) Obedience or self-reliance
4) Being considerate or well behaved

Scale 8: Tolerance for Ambiguity (Budner, 1962)

Please rate your agreement with the following statements. (1 = *Strongly Disagree*, 9 = *Strongly Agree*)

1) An expert who doesn't come up with a definite answer probably doesn't know too much.
2) I would like to live in a foreign country for a while.
3) There is really no such thing as a problem that can't be solved.
4) People who fit their lives to a schedule probably miss most of the joy of living.
5) A good job is one where what is to be done and how it is to be done are always clear.
6) It is more fun to tackle a complicated problem than to solve a simple one.
7) In the long run, it is possible to get more done by tackling small, simple problems rather than large and complicated ones.
8) Often the most interesting and stimulating people are those who don't mind being different and original.
9) What we are used to is always preferable to what is unfamiliar.
10) People who insist upon a yes or no answer just don't know how complicated things really are.
11) A person who leads an even, regular life in which few surprises or unexpected happenings arise really has a lot to be grateful for.
12) Many of our most important decisions are based on insufficient information.
13) I like parties where I know most of the people more than ones where all or most of the people are complete strangers.
14) Teachers who hand out vague assignments give students a chance to show initiative and originality.
15) The sooner we all acquire similar values and ideals the better.
16) A good teacher is one who makes you wonder about your way of looking at things.

Scale 9: COVID risk perception/perception of regulations (first from Makhanova & Shepherd, 2020, last two from Dryhurst et al 2020)

How do you think COVID-19 compares to the seasonal flu? (1 = *It is much less dangerous*,9 = It *is much more dangerous*)

Getting sick with the coronavirus/COVID-19 can be serious (1 = *Strongly disagree, 9 = Strongly agree*)

Thinking back, how worried were you about coronavirus/COVID-19... (1 = *Not at all worried*/9 = *Very worried*)

1) Beginning of the pandemic
2) 1 month ago
3) 2 months ago
4) 3 months ago
5) 6 months ago

What do you think of the planned response from the government in the country you are living in?

I think the response in the past few months was..
I think the response in the next few weeks is..
I think the response in the next few months is..

(Not firm enough with restrictions on people/Putting too many restrictions on people/I don't know what the response is or was)

Scale 10: Trust in groups (also Dryhurst et al 2020)

How much do you trust each of the following? (1= *Cannot be trusted at all*, 9 = *Can be trusted a lot*)

1) People in your family
2) People in your neighbourhood
3) People you work or study with
4) People who speak a different language from you
5) Strangers
6) Immigrants
7) Medical doctors and nurses
8) Scientists
9) Politicians in the country you are living in
10) Journalists
11) The current government of the country you are living in
12) Scientific knowledge
13) Civil servants or public officials in the country you are living in

(NOTE: Trust of ingroups subscale contains items 1 through 3, trust of outgroups contains items 4 through 6, trust in science corresponds to items 7, 8, and 12, trust in institutions corresponds to items 9, 10, and 13).

Scale 11 : Social unity/access to resources (original creation)

To what extent do you think the citizens of your country generally have access to each of the following? (1 = No at all, 9 = Very much)

1) Health care
2) Education
3) Employment opportunities
4) The ability to start businesses
5) Saving for retirement
6) Running for public office

The annual composite of the Tevis Cup non-finishers from the Western States Trail Foundation (www.teviscup.org) will be obtained for 2016-2019 and 2021 ride years. A ride season spans from December 1 to November 30. Data reported includes pulled times, reason for pulls, pull locations, elevation at pull locations, and climate when pulled. Non-finishers, or pulls, are categorized as cases. Horse history will be obtained from the American Endurance Ride Conference (AERC), the national governing body for long distance riding, (www.aerc.org). Data includes overall miles, overall rides started, overall completions, 100-mile starts, and 100-mile completions but will be converted into kilometers. Collection of information assumes that data were recorded accurately into the AERC and WSTF websites.

Results

a. The non-completion rates for the Tevis Cup have stayed consistent during this time cycle of the ride.
b. Age does not play a factor in elimination rates.
c. Arabians and Arabian cross-breeds were the majority of the horses.
d. Geldings were pulled the most.
e. There is a statistical difference in the overall kilometers, rides, 160 km starts, and 160 km completions between horses that finished and pulled.
f. Horses tend to be pulled the most at Robinson Flat, whic is 36 miles into the ride and is at 6,730 feet elevation.
g. Data from 1955-2005 shows mean completion rate of 57.02% with a high being 80% in 1955 and a low of 36.11% in 1959.

Discussion

So, from looking at the years 2016-2019 and 2021, the non-completion rates for horses in the Tevis Cup are as shown, with a P-value of 0.963. This tells us that there is no statistical difference in the rate of completion across all five years and so the non-completion rates for the Tevis Cup have stayed consistent during this time cycle of the ride. This may be because the Tevis Cup is a heavily regulated sport that cares immensely for the health and wellness of the horse. And for that reason, only the absolute best athletes are able to complete the ride.

Surprisingly, my results concluded that there was no statistical difference in the age of horses. You would think that an older horse would be more likely to be pulled but that is actually not the case. Age does not play a factor in elimination rates.

The statistics gathered on breed supported our earlier predictions that Arabians and Arabian cross-breeds were the majority of the horses, mostly due to possessing higher endurance and stamina abilities. As for sex, our data shows that geldings, or a castrated male horse, is pulled the most because geldings are the majority of the horse population.

Overall, there is a statistical difference in the overall kilometers, rides, 160 km starts, and 160 km completions between horses that finished and pulled. However, there needs to be an additional investigation to see what the correlation is and look at other factors such as rider experience, climate, elevation, etc.

From looking at the trend of horses being pulled the most at Robinson Flat, something to consider for further study is how elevation affects elimination rates.

The endurance ride was not as regulated back then as it is today. It is also noteworthy to mention that the former study done by Bhatt shows that at the beginning of Tevis, only 5 riders started and we see that over time, the amount of riders that have started the Tevis Cup has increased. The 271 starters is a deviant because there was a random spike in riders participating in the 1980s. This shows that the sport has grown in popularity and that despite this growth, elimination rates have still stayed consistent.

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Jenkins   **Synthesis of Novel Molecules from cis-Pinonic Acid as Potential**
Cherish   **Therapeutic Agents**

Introduction

In the series of experiments that researchers from a university in China that published this work in the Journal of the Chemical Society of Ethiopia conducted, their main, projected goal was to discover new kinds of bioactive products. To do this, they need to use a terpene called α-pinene. Terpenes are among the easiest "chiral precursors" since they are widely available at a low cost. The introduction of their research states α-pinene has been used as a starting material1 across almost all industries due to the useful products that they can produce under different conditions. Through the use of α-pinene to produce pinonic acid, and the synthesizing of different kinds of its acetamide derivatives4, these researchers are able to pave way for discovering new kinds of bioactive products.
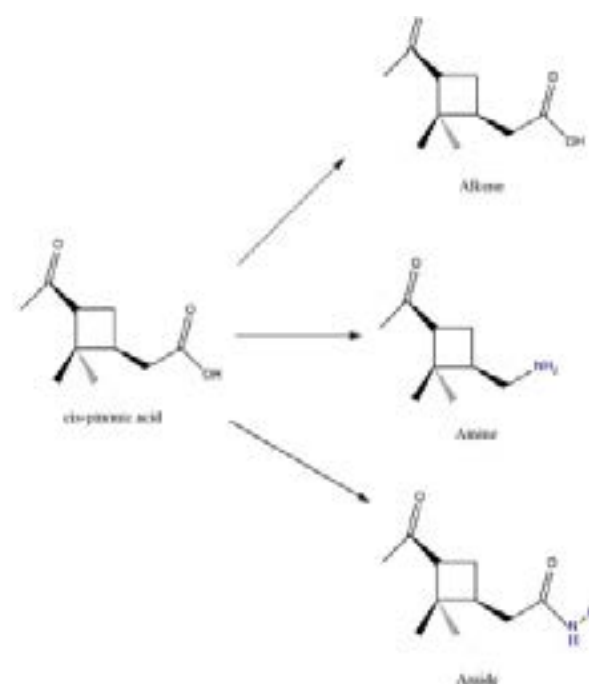
Figure 1. cis-pinonic acid and some of its derivatives

Before new kinds of bioactive products can be discovered, a reproducible way to efficiently produce pinonic acid in good amounts and purity must be found. It is stated that pinonic acid is able to be synthesized through the oxidation of α-pinene with the help of oxidants. It was thought that "since α-pinene is oil-soluble and the reaction medium is water, the usage of phase-transfer catalysts may be useful to the reaction." Unfortunately, it was found that the phase-transfer catalyst that was used was not useful to the reaction.

While they were conducting the above step through oxidation, it was found that a by-product of it (KOH) was produced and that the overall reaction solution was alkaline. Due to this, it was known that using pH regulators was beneficial when it came to the process of oxidation. While experimenting, it was found that using high acidity compounds as pH

regulators affected the yield of pinonic acid greatly. For example, using hydrochloric acid as a pH regulator resulted in a yield of less than 25%. They proceeded to then explore low acidity compounds and decided to use ammonium sulfate, which was then used as a pH regulator in the oxidation and was found to produce a pinonic acid yield of 60% after filtration was used.
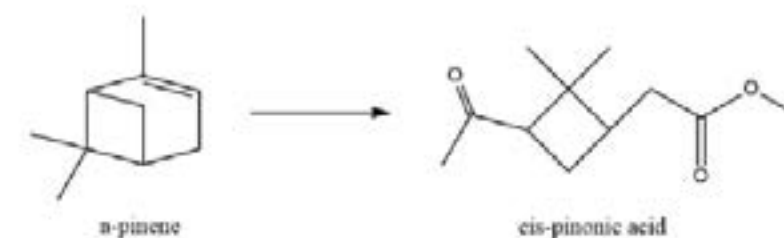
Figure 2. Reaction scheme of α-pinene to *cis*-pinonic acid

Using the literature procedure for reference, the goal of our experiments is to efficiently produce cis-pinonic acid from α-pinene while trying to obtain the highest yield possible.

Results and Discussion

One experiment was run, and it produced a yield of 19%. α-pinene was mixed with water, which was then mixed with ammonium thiosulfate. After this, while keeping a temperature of below 10 °C, potassium permanganate was added while stirring, which lasted until the purple color from the permanganate disappeared. The solution stirred for a total time of 1 hour, but unfortunately the color from the potassium permanganate never disappeared. Upon observing the solution after the stir time, a film of oil was visible on top of the solution, which suggests unreacted α-pinene. Despite this, the experiment still proceeded. Concentrated sulfuric acid was added to the solution as well as sodium thiosulfate. During this, the solution gradually became clear and then turned a brown-yellow color suggesting that the sodium thiosulfate is reducing MnO_4^- to MnO_2, which destroys the remaining permanganate and stop the reaction. After this, the procedure for extraction was conducted. The aqueous solution was thoroughly washed several times with diethyl ether in a separatory funnel, and then the aqueous solution was separated from the diethyl ether. To make sure the final product is all that was left, the solution was rotovap'd. Weighing this final product led to a yield of 19%, which suggests that some product was formed. After this, a TLC was performed which showed positive for cis-pinonic acid. In order to be able to obtain more structural information, an NMR was taken. This NMR gives evidence for there being a lot of impurities in the final product due to the appearance of many additional peaks aside from those reported for cis-pinonic acid. Due to the complex nature of the spectrum, it is difficult to tell exactly how much cis-pinonic acid was produced. The reaction itself seemed successful, but another NMR or another experiment would have to be conducted to confirm cis-pinonic acid was actually produced.

Conclusions

To conclude this project, the goal was to synthesize α-pinene into cis-pinonic acid. This was done through the use of solid ammonium sulfate as a buffering agent and

potassium permanganate as an oxidation reagent. Due to the persistent purple color indicating the presence of permanganate, sulfuric acid and sodium thiosulfate were added to quench remaining permanganate. After the reaction completed and the final product was obtained through rotovap, a yield of 19% was obtained. Since the NMR was not identical to that of the one that was collected of the final product, suggesting the presence of impurities, the true yield of cis-pinonic acid that was obtained is likely somewhat lower than 19%. One of these impurities would likely be manganese byproducts such as manganese dioxide. Something that was interesting while working on this project is why the results were not completely as stated in the literature,3 and why some reactions proceeded differently.

Future Directions

One question that continuously arose throughout the experiment was why does the purple color from the potassium permanganate not disappear like the literature procedure states?3 This is something that still needs to be determined. The potassium permanganate color not disappearing could also be a reason why some is typically found unreacted. NMR data was collected for the final product that was produced, and it does not quite match the literature NMR along with the fact that it had an abundance of peaks, which could suggest impurities. This is something that needs to be explored more, and more experiments need to be run. Some things that can be explored to see if it affects the final yield are reaction times, reaction temperature, and the use of different reagents such as a different acid besides concentrated sulfuric acid.

Experimental

First, 1.0 g of α-pinene was mixed with 10 mL of water. This solution was mixed with 0.506 g of ammonium sulfate. At this point, the temperature is kept at below 10 °C, and then 2.65 g of potassium permanganate was added while stirring the solution ideally until all purple color disappeared. This stirring proceeded for 1 hour. After 1 hour passed, 8 pipettes worth of concentrated sulfuric acid was added to the solution, along with 3.06 g of sodium thiosulfate. This solution was stored in a fridge for about a week, and then extraction began. The aqueous solution was poured into a separatory funnel, and diethyl ether was added until there was a clear difference between the two solutions. The separatory funnel was shaken 3 times, and was vented after each shake. The the aqueous and organic layers were drained into separate dry Erlenmeyer flasks. This extraction step was repeated two more times. After the extraction was complete, the solution was concentrated via rotary evaporation to remove all diethyl ether, yielding a crude solid product. The weight of the empty rbf weighed 82.040 g. After rotary evaporation the weight of the flask plus crude solid was 82.295 g which determined that there was 0.255 g of crude. Based off of this value and the theoretical yield, a percent yield of 19% was produced. A TLC was then taken, along with an NMR. This experiment was adapted from literature procedures.2,3

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Jimenez Jezzabella   **Multilinguistic Identities and Second Language Speech**

Those who speak two or more languages are fundamentally different from monolinguals, not only in their linguistics repertoires but also in how they identify with their languages and identify with those with whom they interact. These multilinguistic identities and perceptions of how listeners judge speech can have an effect on language users' pronunciation. The current study looks at the differences between two language groups. Fifteen second language (L2) speakers of English were compared with 15 heritage language learners (HLLs). Mixed methods were used to describe how L2 speakers of English and HLLs perceive the listeners' attitudes and how the construction of their identity in additional languages affects their overall speech patterns. Patterns demonstrated that the interaction between language, speakers' perception of the listener, and culture can exert an influence on language learners' speech patterns. Additional findings indicate that L2 speakers have a slightly elevated awareness of how listeners perceive their speech. Overall, language and identity are multifaceted and dynamic and affect speech in subtly different ways for both L2 speakers and HLLs.

Introduction

Both heritage language learners (HLLs) and second language (L2) learners of English basculate the use of two or more languages, but in different ways and oftentimes from different ages. L2 speakers often do not grow up learning English bilingually in the home setting. L2 speakers tend to acquire additional language later on in life after the age of puberty, often outside the home, and through formal education (Mak et al., 2015). HLLs, on the other hand, tend to acquire additional languages naturally in the home setting where another language besides English is primarily spoken (Bowles, 2011; Pascual, 2017; Valdes, 2000; Xiao, 2006).

Marx (2004) and Piller (2002) note that acquiring additional languages is also acquiring additional identities. For both L2 speakers and HLLs, their speech communities can shape their separate language identities (Sung, 2016). Furthermore, learners' speech patterns, identities, and desires for target-like pronunciation are affected by how these language learners perceive listeners to react to their speech. The present study considers how identity affects speech patterns and examines the relationship between language, identity, and the effects of listeners' perceptions on the speaker. With the discovery of more information about these speech patterns, educators can account for individuals with multilinguistic identities and consider the variety in their speech patterns, experiences, and cultural backgrounds.

Language Users' Perceptions of Listeners' Judgments

How one relates to others helps to shape their identity, which in turn provides a directive for which language or accent they would choose when communicating with others (Harrison, 2012; Marx, 2002; McCrocklin & Link, 2016). Language users may be affected by listeners' perceptions due to the context in which they are speaking, the importance of the

conversation, and the stakes involved with the interaction. For high stake situations, both HLLs and L2 speakers of English may feel that the listeners' perception of their speech will cause them to speak with higher usage of more complex vocabulary or with a minimized accent (McCrocklin & Link, 2016; Moyer, 2007). Additionally, language users may feel affected by the listeners' response to their statements and change their speech patterns accordingly. If the conversation is very important, the speaker may feel additional pressure to change their word choice and accents to sound as articulate as possible (Sung, 2016). Even more, if the conversation is high stakes, the speaker may want to be very clear and concise to get their point across with the linguistic repertoire they have.

Multilinguistic Identities of Language Users

As people go through life learning their native tongue or/and a new language, they develop a sense of identity attached to their languages. As their identity develops, the use of language is affected by others with whom they interact. Piller (2002) found that "users make identity choices and position themselves in relation to other discourse participants" (p. 183). This shows that as language learners begin to navigate through their daily life, they make decisions on how they identify with the world around them and create spaces around themselves where these identities can grow (Heller, 2003; Piller, 2002). This discovery process can lead to finding a deeper sense of identity in some languages depending on the amount of time spent using that language (Harrison, 2012).

L2 speakers and HLLs grow up with different language learning experiences. HLLs learners tend to grow up speaking their heritage language and English in the home setting while L2 speakers of English tend to grow up speaking their native language until their additional language is acquired at a later point in time. Due to this, L2 speakers of English may not feel as confident in their English speaking skills, especially if they learned their English language skills post-critical period (Moyer, 2014). Piller (2002) also adds that L2 speakers of English often create a new language variety to comfortably communicate with those around them. Marx (2002) finds that L2 speakers of English initially feel displaced and then develop their language identity in a stage of recovery and reconstruction. In the stage of recovery, the L2 speakers of English develop their own meaning and experiences in their L2. While both HL learners and L2 speakers use more than one language, these two groups have unique linguistic experiences which can affect their identity in different ways.

Research Questions

To describe differences between how L2 speakers of English and HLL's patterns of speech are affected by listeners' attitudes, in addition to how these two groups construct their linguistic identities, the study seeks to respond to the following research questions:
RQ1: How does a speaker's perception of listeners' language attitudes affect speech patterns for heritage language learners and second-language speakers of English?
RQ2: To what extent does identity exert an influence on speech patterns for heritage language learners and second-language speakers of English?

METHODS

Participants

Thirty participants from a major four-year university on the Pacific West Coast participated in this study. Sixteen of the participants were L2 speakers of English with the following language background: Spanish n = 5; Chinese n = 3; Vietnamese n = 2; Japanese n = 2; Thai n = 2; Russian n = 1; and other n = 1. Fourteen of the participants were HLLs. The first languages of the HLLs were the following: Spanish n = 9; Taishanese n = 1; Burmese n = 1; Vietnamese n = 1; Korean n = 1). The average length of residence (LOR) (amount of time living in the United States) for the L2 participants was 4.29 years while the average LOR for HLLs was 22.79 years.

Materials

Bio Questionnaire

The participants filled out a bio questionnaire using Qualtrics which provided the research team with information regarding the participant's gender, age, length of residence, country of birth, spoken languages, and level of language proficiency.

Language Attitude Survey

The participants also filled out a language attitudes survey on how the listener's perception of the speaker influenced their speech patterns. The questions sought to understand how aware participants were of listeners' perceptions of their speech, and in turn, how listeners' perceptions affected their speech patterns. For example, some items focused on whether participants felt like they could express themselves fully in English and if they felt the need to sound native-like or not. Other items focused on whether participants tried to sound more native-like with friends or family. In the language attitudes survey, participants rated how much they agreed with the statements on a scale from 1-5 (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree).

Semi-Structured Interview

After the participants completed the bio questionnaire and survey, they were invited to participate in a semi-structured interview. While the interview tended to last between 20-25 minutes and had an extended interview protocol, only specific items were analyzed for the context of the current study. These items focused on multilinguistic identities and speech patterns. In the interview, the participants were asked if English reflected their cultural identity. Participants were also asked if they had ever tried to hide or manipulate their identity through the use of specific speech patterns. Additionally, the research team asked if they ever tried to express their identity through the use of specific speech patterns.

Data Analysis

To analyze the data from the attitudes survey, descriptive statistics were calculated. That is, the mean and standard deviations of the scores on the rating scales were obtained. They are displayed below in Table 1.

Table 1

Speaker's Impressions of Listeners' Perceptions

	Heritage Language Learners			Second Language Learners		
Survey Item	*n*	*M*	*SD*	*n*	*M*	*SD*
1. Listeners' perceptions and/or judgments of my English make me feel like I need to sound native-like.	14	2.5	1.51	15	3.73	1.16
2. Listeners' perceptions and/or judgments of my English make me feel like I can't fully express my identity in English.	14	1.79	1.42	16	3.31	1.35
3. I am very aware of how listeners perceive me when I speak English.	13	2.92	1.50	16	4.06	.85
4. I feel more myself when I feel like listeners are not negatively perceiving or judging my English speech patterns.	14	3.21	1.81	16	4.19	.83
5. Listeners' perceptions and judgments play a role in how close I feel with American culture.	14	2.86	1.61	16	3.63	1.26

6. I am more likely to try to sound native-like in English if I am using English with my friends.	14	2.5	1.61	16	3.25	1.24
7. I am more likely to try to sound native-like in English if I am using English with my family.	13	2.15	1.21	15	1.87	1.06
8. I am more likely to try to sound native-like in English if I am using English with other members of the community.	13	2.62	1.66	15	3.87	1.19

Descriptive statistics based on the following scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

To analyze the interview data, participant responses were first transcribed. After, the responses were analyzed based on recurring themes within the data, codes were assigned to each response After each participant's response was assigned a code, codes were tallied up to create numeric markers which indicate how many participants had similar responses.

RESULTS

Perceptions of Listeners' Attitudes

Table 1 above displays the results of the language attitudes survey. Each survey item is presented along with the number of participants that responded to that survey item, the sample mean, and the standard deviation. In response to the survey item, "Listeners' perceptions and/or judgments of my English make me feel like I need to sound native-like," the majority of HLLs felt that they disagreed with the statement while L2 speakers felt that they were neutral or agreed with the statement. HLLs tended to feel that listeners' perceptions and judgements of their English make them less able to express their identity in English while L2 speakers felt neutral about listeners' perceptions and judgements affecting the expression of their identity. The results seem to indicate that HLLs may be less aware of how listeners perceive their English to sound while L2 speakers may seem more aware of how listeners perceive their English to sound. HLLs were neutral about feeling more themselves when listeners were not negatively perceiving or judging their English speech patterns, while L2 speakers did feel more themselves when listeners were not negatively perceiving or judging their speech patterns. Often, HLLs believed that listeners' perceptions and judgments played a role in how close they felt with American culture. L2 speakers felt that these perceptions and judgements were neutral about the connection between their languages and their closeness with American culture. HLLs felt that they agreed when

asked if they attempted to sound native-like in English if they are using English with my friends. L2 speakers felt that neutral about attempting to sound native like while using English with their friends. HLLs seem to not try to sound native-like in English if they are using English with their family while L2 certainly did not try to sound native-like in English while speaking in English with their family. HLLs may not be more likely to try to sound native-like in English while using English with other members of the community while HLLs were neutral about sounding native-like with members of the community.

Identity Interviews

The identity interviews consisted of questions about multilinguistic identities. When the thirty participants were asked "Which language do you speak that you feel you identify with the most," twelve (HLLs = 9, L2 speakers = 3) of the participants responded with English, twelve participants (HLLs = 3, L2 speakers = 9) responded with either their heritage language or native language, and four responded (HLLs = 3, L2 speaker = 1) with a mix of both their heritage language or native language and English. The reasoning behind the participants' responses were their education, their significant others, the amount of usage each participant has with the language, their ability to express themselves in their language(s), and their independence of either language.

After asking the participants "What language do you speak that is most closely connected to your culture," twenty-four participants (HLLs = 11, L2 speakers = 13) responded with their heritage/native language, four participants (HLLs = 13, L2 speaker = 1) responded with English, and one responded (L2 speaker = 1) with a mix of both their heritage/native language and English. The participants' reasoning was the amount of time spent using the languages, the ability to express themselves in their languages, and also the surrounding community of significant others. In response to the follow-up question of the question stated above, "Does English reflect your cultural identity," nine participants (HLLs =3, L2 speakers = 6) indicated that English partially reflected their cultural identity, eight participants (HLLs = 2, L2 speakers = 6) indicated English did not reflect their cultural identity, and five participants (HLLs = 2, L2 speakers = 3) stated English did reflect their cultural identity.

When asked "Have you ever tried to express your identity through the use of specific speech patterns (i.e., you tried to sound a certain way to identify with a particular group); if so, in which language do you do this," nineteen participants (HLLs = 12, L2 speakers = 7) said they have tried to express their identity through the use of specific speech patterns while eleven participants (HLLs = 2, L2 speakers = 9) said they had not tried to do so. Participants that did change their speech patterns did so based on their interlocutor. Participants that did not try to change their identity did not because they felt they were unable to or because they wanted to show their identity through content rather than speech patterns.

After asking the participants, "Have you ever tried to hide or manipulate your identity through the use of specific speech patterns? If so, in which language do you do this," fifteen responses were received from participants (HLLs = 7, L2 speakers = 8) stating they tried to hide or manipulate their identity with thirteen responses stating the participants (HLLs = 6,

L2 speakers = 7) had not tried to do so. When participants affirmatively responded, they felt they were attempting to speak correctly, or their speech patterns were influenced by friends and family. When participants responded negatively, their reasoning was because it minimized their identity, they felt the content of their speech was more relevant, and they felt individualistic.

DISCUSSION

The first research question explored the role of listeners' language attitudes on speech patterns for both HLLs and L2 speakers of English. In this study, it was found that L2 speakers and HLLs differed in how they perceived listeners' perceptions and in turn, how these perceptions affected their speech. Both L2 speakers of English and HLLs have multilinguistic identities that play out differently depending on how they perceive listeners to react to their speech. This study seems to indicate that because HLLs grow up comfortable speaking the dominant language, they are still aware of how listeners perceive them but to a much lesser extent than L2 speakers who have learned English at a later point in life. On the contrary, L2 speakers appear to be more affected by listeners' perceptions which make them strive for native-like pronunciation.

The second research question explored how identity exerts an influence on speech patterns for HLLs and L2 speakers. L2 speakers of English and HLLs are similar in terms of their identity being closely connected to their native language and heritage language. One major difference that was found was that L2 speakers of English tend to identify more with their native language while HLLs identify more with English. The identity interviews suggest the identity of both heritage language learners and second language learners has been affected by participants' educational goals and experiences, their relationships, and interactions with significant individuals in their lives, their usage of their languages, and their capabilities in their languages. Second language learners of English positively viewed the production of a native-like accent, which connects with McCrocklin and Link's (2016) findings of L2 speakers desiring to speak with a native-like accent. Research finds that speaking native-like English can be connected with a sense of superiority and be crucial to economic mobility (Harrison, 2012; Sung, 2014). Previous research found that many L2 speakers of English felt that it was very important to pronounce words properly (Derwing, 2003), which is congruent with the findings in the current study. Oftentimes second language learners of English felt it was important to use proper English in high stake situations which relates to Sung's (2014) findings that speaking English with a native-speaker accent is connected to a high level of language proficiency.

The findings of this research study have also suggested that the second language learners of English participants' cultural identity has been affected by the longevity of the participants' stay in the United States and the location and community they are submerged in. The patterns from the identity interviews also indicate that the both heritage language learners and second language speakers of English participants' identity has affected their speech patterns in terms of their domain of language use, fluency, slang, and correctness. In many instances, HLLs feel divided between their identities (Marx, 2004; Trisnawati, 2017).

Overall, this study indicated that individuals with multilinguistic identities are multifaceted and distinctly different depending upon their linguistic and cultural background. Both HLLs and L2s speakers of English had their own experiences and perceptions of their linguistic and cultural identity which affected their speech patterns. This study hopes to inform pedagogy by suggesting that educators consider the multilinguistic identities of individuals taking into account their wide range of abilities, experiences, and cultural backgrounds. One of the limitations of this study was that the results are based on self-reported data. However, rich data was provided in this study which showcases preliminary findings which can lay the groundwork for future studies to build upon.

ABOUT THE AUTHOR

Jezzabella Jimenez is a current undergraduate student at California State Polytechnic University - Pomona in the Communication Department. She plans to attend her graduate school program in linguistics beginning in the Fall of 2022. Her research interests are in language acquisition, L2 speech patterns, bilingual education, speech perception, culture, and identity.

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Jimenez   **Transitional Bilingual Education versus Dual Language Immersion**
Jezzabella   **Programs :Students Views on their Preparedness for College**

Abstract

Over the past five decades, educational linguists have been keenly interested in the effects of Transitional Bilingual Education (TBE) and Dual Language Immersion (DLI) programs on the academic achievement and literacy skills of language-minority students. Early TBE has been shown to improve oral vocabulary and literacy development in the home language at no cost to English language and literacy development (Durán, 2014). Receiving academic instruction in their native language helps students develop both their academic abilities and English literacy (Cummins, 1976). DLI allows for language proficiency and academic achievement in both languages while also providing a cross-cultural understanding. Valdes (1997), however, questions the quality of DLI instruction, as she examines how language and power relate. Little research has documented how the two types of programs compare. Even less has been done to investigate the students' perspectives on TBE and DLI. The current study examines the relationship between these two modes of instruction through analyzing survey and interview data collected from current college students who participated in either TBE or DLI in K-12. My initial hypothesis is that students' experiences in the TBI or DLI program influence their perceptions of how well they are prepared for college-level studies. This is important for teaching and subsequent research, as more is discovered about the similarities and differences between TBE and DLI. This study will help the public, educational institutions, and teachers in further improving TBE and DLI programs and in influencing the policies regarding bilingual education.

Aims and Objectives

The present study aims to add to the existing literature by examining how students' views of their preparedness for university is influenced by either their transitional bilingual education or dual immersion programs. This study will allow for a deeper understanding of how these educational programs are influencing students' perceptions of their preparedness for university, using information from the participants regarding their perceived readiness for college. Through the analysis of survey and interview data, this research will cover what factors in transitional bilingual education and dual language immersion programs influence the students' views of their readiness for college.

The goal of this research project is to develop a stronger understanding of how bilingual education and dual language immersion programs are influencing students' views of their preparedness for college. The research question is as follows: How does transitional bilingual education versus dual language immersion programs influence students' views on their preparedness for college. By conducting this research, the goal is to find existing patterns in how students' views of their preparedness for university was influenced by these educational programs. The results from my study will give insight to how each program is run and is helping or hindering the students.

Review of literature

Transitional Bilingual Education

English language learning has become a huge part of the United States education system which heavily contributes to the country's diversity (Garza-Reyna, 2019). Each distinct program is responsible for the academic preparation of the English language learner and to help them succeed in K-12 education and beyond. There are many different types of bilingual education, including dual language immersion programs and transitional bilingual education. Durán, Roseth, & Hoffman (2014) have found that transitional bilingual education has the potential to improve the second language oral vocabulary development and the early letter-word identification skills with no discernable cost to English language learning and literacy. This shows that transitional bilingual education can be useful for second language learners as they figure out how to balance both of their languages. Over time, academic instruction in a child's native language will help to improve their academic and literacy skills in English (Cummins, 1979; Krashen, 1999).

Menken (2013) finds that emergent bilinguals and their peers are performing at different rates, indicating the need for additional support for the emergent bilinguals. Chokwe (2013) addressed the socio-economic factors that contribute negatively to student learning. Oftentimes, students who are in transitional bilingual education courses often come from low-income schools. Menken (2013) also notes the importance of professional development for all teachers that are assisting students in developing their language and literacy skills. Researchers (McNeil & Valenzuela, 2000) have found that emergent bilinguals in America are at a higher risk of dropping out, grade retention and course failure. This shows the importance and need for bilingual education for students that speak two or more languages. Studies show that it takes many years of living in a country and attending formal school for second language learners to reach a similar achievement as first language speakers (Wayne & Collier, 1997). Malaraz (1998) notes that bilingual education can be organized as cognitive development, affective development, linguistic growth, and cultural enrichment. This author also finds that transitional bilingual education uses the native language and culture only when necessary for the child to acquire English and then function in the regular school curriculum (Malaraz, 1998).

Dual Language Immersion

Dual language immersion programs promote linguistic and cultural diversity by encouraging the children to become literate in their native language and to develop bilingual skills through their schooling years and beyond. Bucholtz (2014) has expressed that all language users should be viewed as experts that are capable of contributing to the linguistic and cultural knowledge in the classroom. This exhibits the importance of allowing students to use both their native tongue and their English language. Steele, Slater, Zamarro, Gema, Miller, Trey, Li, Jennifer, Burkhauser, Susan, Bacon, & Michael (2017) find that after seven to nine months of language immersion learning, students that were randomly assigned to these programs outperform their peers on state tests in reading. This displays that dual language immersion is truly useful in achieving the goal of preparing the child academically for their life beyond K-12. Calderon (2011) suggests that effective educational programs contain constant collection and use of data on educational outcomes, strong focus on professional development, standards for classroom management, and focused leadership.

Oxford (2001) documented the way that language learning is separated from content learning. This separation of language learning and content learning causes issues in academic success for English language learners because they fall behind in their content while solely focusing on learning English. Teachers play a major role in the success of the student in their language learning abilities and overall academic achievement. This author also finds that it is best to teach language learning strategies and emphasize the importance of using these strategies to enhance performance in other skill sets outside of the bilingual education classroom (Oxford, 2001). Research has found that the image of students may become problematic when the student population is inaccurately represented, so much so that it inhibits the teacher's ability to recognize and address the presence of differences in the classroom (Matsuda, 2006). Research has also shown that teachers frequently felt that students' individual differences were their most pressing problem (Nikolov, 2009). This indicates that there may be a lack of techniques to assist in managing classes with students of varied abilities. Chokwe (2013) brings up the lack of unity between high schools and colleges/universities in terms of preparing students for the writing demands required of students in higher education.

Methods

Population and Sample

This research project will seek to interview bilingual/multilingual students that have received transitional bilingual education or dual language immersion instruction from all over the United States. These students will be bilingual/multilingual and will have had a portion or more of their education in a bilingual education program. Moreover, the students will specifically have received either bilingual education in a dual language immersion program or in a transitional bilingual education program. These participants would have received their education in the United States. Students who participate as transitional bilingual education students will have received a bilingual education that focuses on transitioning students from their native language to English while using parts of the native language as a support system (Slavin & Cheung, 2005). Students who participate as dual language immersion program students receive instruction in both languages while combining native and non-native speakers in the same classroom (Kim, Hutchinson, & Winsler, 2015). The number of participants in this study will be approximately thirty.

Data Collection

For this research project, the plan is to collect data beginning in late August of 2021. Upon approval from the Institutional Review Board (IRB), data collection will begin by distributing a survey to the potential participants (See Appendix A). This distribution will be through California State Polytechnic University - Pomona. At the end of the survey, there will be a question asking if any students would be willing to participate in an interview. From there, a subset of all the students that responded to the survey will set up a time to interview with the principal investigator. For students that are available for the interview portion of

data collection, the interview questions will be asked from the interview protocol (See Appendix B). They will be asked questions detailing their experience within the transitional bilingual education or dual language immersion programs, their typical learning methods and materials used in their programs, and how this experience, methods, and materials helped or hindered them in their preparation for university. All data will be made confidential through saving the data on a password protected computer. Some potential barriers in carrying out this research design include biases in the participants' responses. There is an anticipation of biases because participants may not reveal what they really think because they want to be viewed in a positive light without regards to anonymity, the participants may not be objective about themselves and tell the principal investigator what they think the principal investigator wants to hear, and participants may disregard the truth to protect themselves, their ego, or to be controversial. To ensure quality data is collected and avoid missing data from the sample of the population, the survey has been prepared to be fairly short and for the interview questions to have no leading questions and as few open-ended questions as possible. A copy of the survey questionnaire (Appendix A) and interview protocol (Appendix B) can be found in the appendices below.

Results

This study examined bilingual education students that had either participated in dual language immersion or transitional bilingual education programs. Some of the participants did receive bilingual education but were not sure what kind of bilingual education they received. The survey items were developed in response to the research question: How does transitional bilingual education versus dual language immersion programs influence students' views on their preparedness for college. Of 33 respondents: 13 students reported not knowing what type of bilingual education they received (39.39%) 10 students reported receiving transitional bilingual education in their educational career (30.30%) and 10 students reported receiving dual language immersion education in their education career (30.30%). This showcases that many students remember having some type of bilingual education but did not know and were not aware of what kind of bilingual education they received (See Table 1.1) . Of 33 respondents: 14 students reported receiving bilingual education in 9th-12th grade (42.42%), 12 students reported receiving bilingual education in grades K-5 (36.36%), 6 students reported receiving bilingual education in "other" grades (15.15%), and 2 students reported receiving bilingual education in 6th-8th grade (6.06%). This finding reveals that many participants received bilingual education in high school and elementary school stages of their academic career (See Table 1.2). In response to the survey item about students preparedness for college due to bilingual education, 12 students felt more prepared for college due to their bilingual education (36.36%), 11 students felt neither less or more prepared for college due to their bilingual education (33.33%), 8 students did not think about how bilingual education affected their preparation for college (24.24%), and 2 students felt less prepared for college due to their bilingual education (6.06%). This showcases that many students felt more prepared for college due to their bilingual education, some felt neither more or less prepared, and occasionally students felt less prepared for college due to their bilingual education (See Table 1.3).

Of 32 respondents: 21 students reported feeling that their bilingual education teacher was helpful during their time in the program (65.63%), 9 students reported feeling that their bilingual education teach was somewhat helpful during their time in the program (28.13%), and 2 students reported feeling that their bilingual education teacher was not helpful during their time in the program (6.25%). These results indicate that a majority of the students felt their teacher was helpful while others felt the teacher was somewhat helpful. Additionally, a couple students felt the teacher was not helpful at all (See Table 1.4). When asked about learning content or language in their bilingual education programs: 24 students reported learning both content and language in their program (72.73%), 6 students reported to have never thought about the distinction between the two while in their program (18.18%), 2 students reported learning language in their program (6.06%), and 1 student reported learning content in their program (3.03%). These results express that the majority of students learned both content and language while a few students learned one or the other (See Table 1.5).

When asked about which part of the bilingual education was most helpful, students felt that their bilingual education helped them with their career, educational, and personal advancement. As well as assisting them in developing their oral, written, and literacy skills. Students also felt that they had a deeper appreciation of community and culture after their bilingual education. An example of a student that felt their bilingual education helped them with their advancement was a student that felt they learned about "cognitive development, multi-tasking, and language skills". One student that felt their bilingual education was assisting them with their oral, written, and literacy skills noted that bilingual education helped them to "focus on learning and retaining grammatical knowledge." Students that felt community and culture helped them prepare for college spoke about how they could communicate with others after learning in this program.

The principal investigator also asked participants what part of bilingual education made them feel least prepared for college. Students reported that they felt least prepared for college due to a lack of logistical preparation, lack of preparation of academics, and lack of support from the surrounding community. A respondent that felt unprepared for college due to a lack of logistical preparation stated that they were "repeatedly taught the basics and never tested on reading comprehension." Students that felt unprepared for college due to the lack of preparation in academics felt they were unprepared for writing courses, language courses, and history courses. One student that felt a lack of support said that teachers pressured them "to completely forget about their native language and continue to fluently speak English."

When asked about the kinds of support offered to students in these bilingual programs, respondents noted emotional support, tutoring, advising, and learning aids. Students that felt emotional support was offered in these bilingual programs felt that a few teachers were supportive and said the student "shouldn't feel ashamed for being able to speak two languages." Other students that felt tutoring, advising, and learning aids support was offered in their program shared that they received extra help during and after classes, tutoring services, rosetta stone, and activities on the computer.

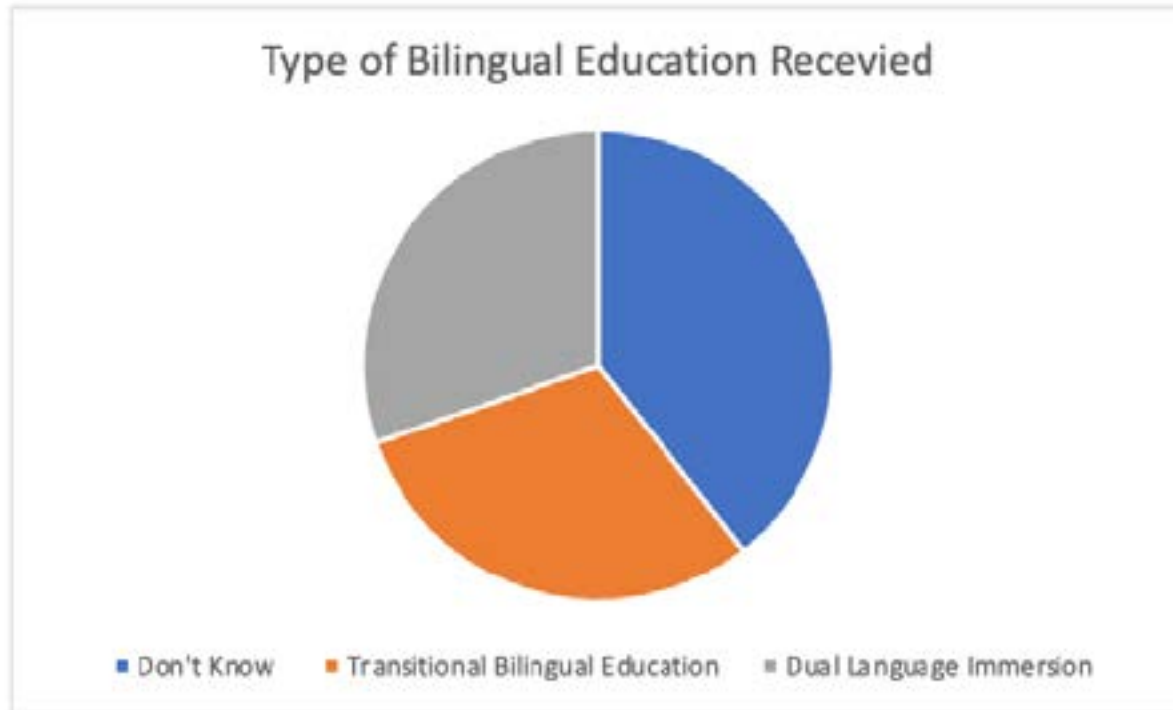Table 1.1 Type of Bilingual Education Recevied

Table 1.3 Students Feelings of Preparedness for College Based on Their Bilingual Education
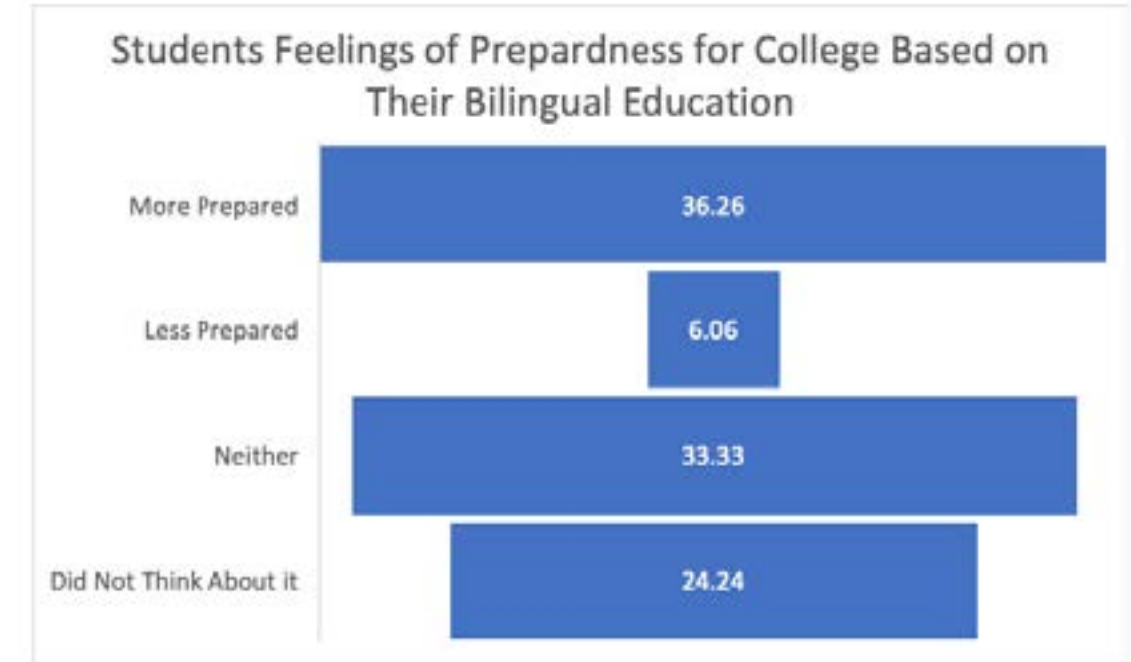

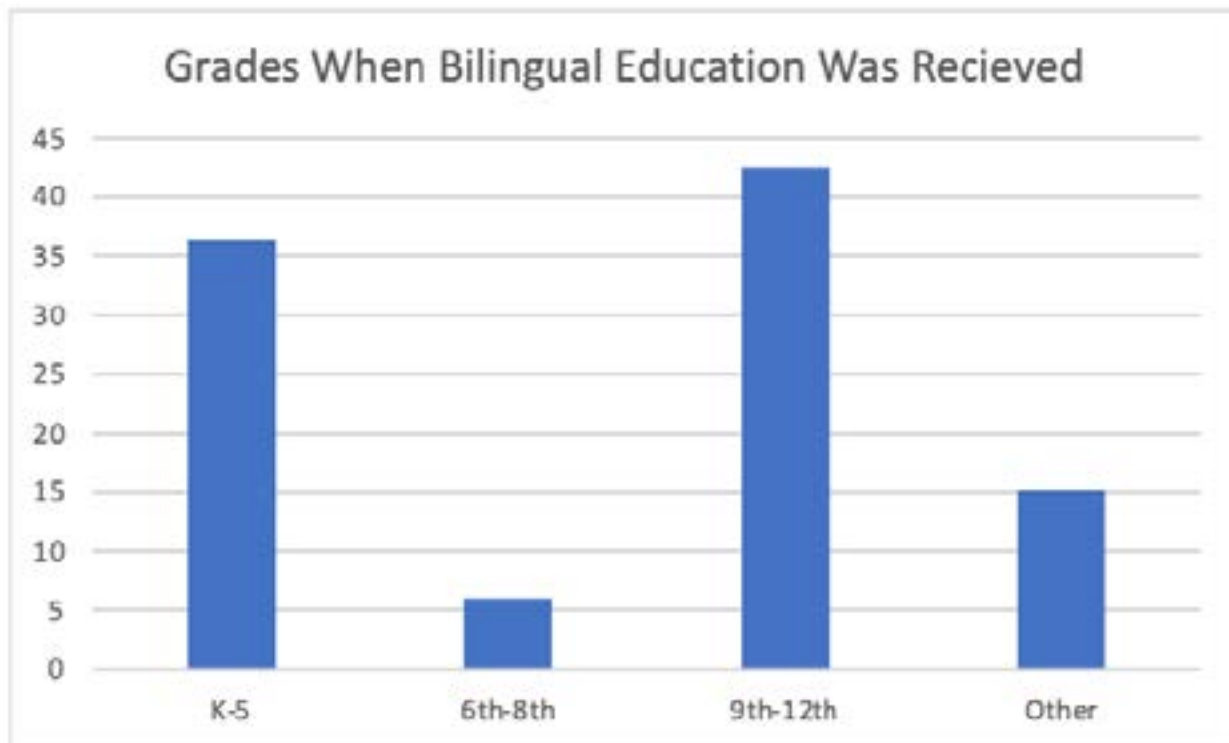Table 1.2 Grades When Bilingual Education Was Received

Table 1.4 Students Views on the Helpfulness of the Teacher During Bilingual Education
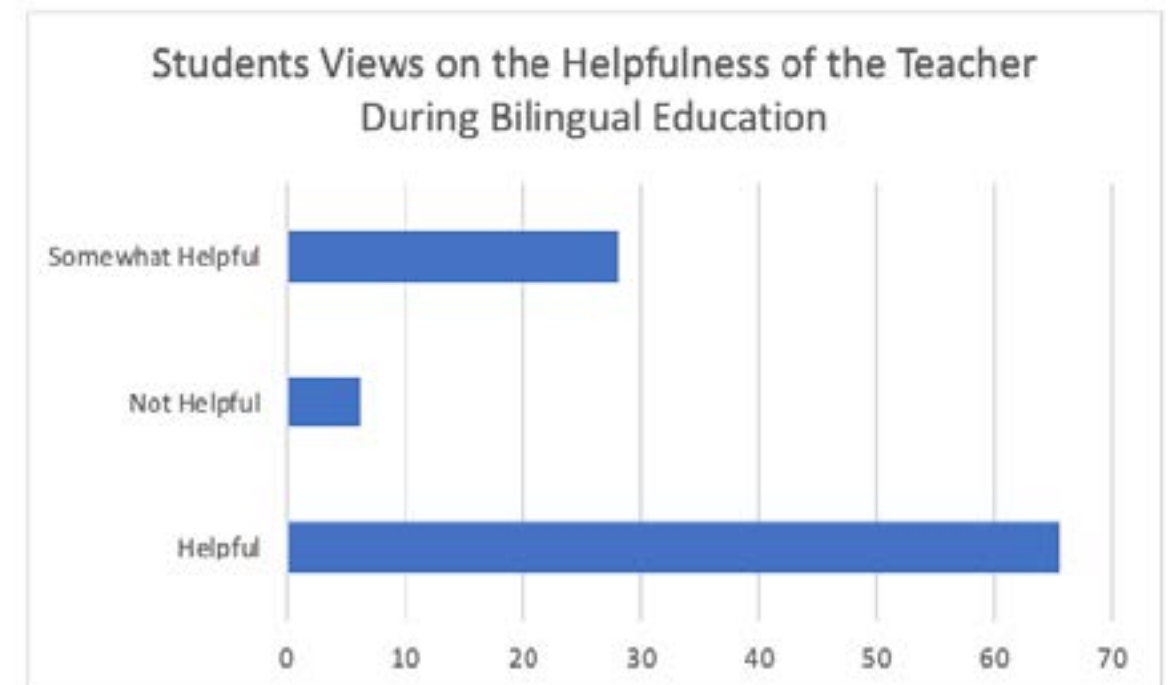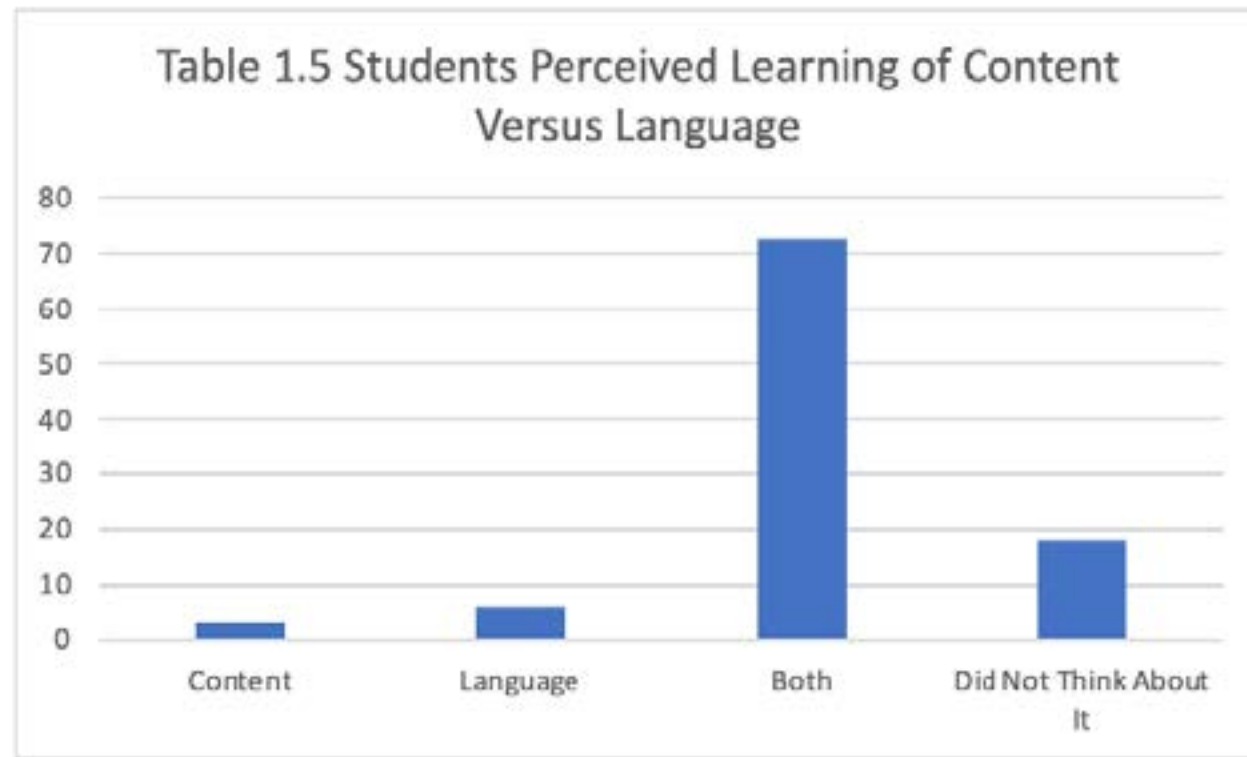
Table 1.5 Students Perceived Learning of Content Versus Language

Discussion

Overall, the results from my study shows that students felt that the bilingual education was helpful in some ways for them. Additionally, there were some aspects of bilingual education that were not perceived as helpful in preparing students for college level courses. The results that were shown in my data were not expected because the original hypothesis was that transitional bilingual education students would feel less prepared for college than dual language immersion students. However, the data shows that both dual language immersion students and transitional bilingual education students gained many strengths from participating in the different bilingual education programs. With respect to my research question: how does transitional bilingual education versus dual language immersion programs influence students' views on their preparedness for college, the results show that students do feel more prepared for college based on their bilingual education. Many dual language immersion students feel more prepared for college based on their program's curriculum while others feel neither less or more prepared. With transitional bilingual education, many students felt more prepared, some felt neither more or less prepared and one felt less prepared. Those that did not know what type of bilingual education they received, mostly felt that bilingual education helped them prepare for college, one student felt it was less helpful, and the others felt it was neither more or less helpful in their preparation for college. These findings are important to myself and society because it is clear that the educational system can use improvements. These improvements can come from taking the stakeholder into account, allowing parent participation in the bilingual program selection, and outlining the goals of the program clearly to students.

Previous researchers, Durán, Roseth, & Hoffman (2014) find that transitional bilingual education can improve second language oral vocabulary development at no cost to English language learning and literacy. The findings of this study are congruent with these findings. Transitional bilingual education participants indicated that their program helped them develop their oral vocabulary. It is assumed that their English language learning and literacy did not suffer as a result of this. Menken (2013) talks about how important it is for professional development to exist as a standard for all teachers. This study shows that the professional development of teachers is crucial as they play a key role in the experiences of the bilingual students. Oxford (2001) touches on language learning and content learning separation. In the current study, many students experienced both language and content learning simultaneously. Malaraz (1998) touches on how bilingual education assists in cognitive development, affective development, linguistic growth, and cultural enrichment. Participants in this study talked about how these programs helped them to develop all the skills listed by Malaraz.

The limitations of this study include the limited time of data collection, limited participants with various backgrounds, and phrasing issues within the survey items. The data collection for this study took place during the duration of a few weeks. With a longer data collection period, more participants could add to the richness of the data and assist with developing more accurate statistics. All of the participants came from California State Polytechnic University - Pomona. Future studies could conduct a similar experiment which draws participants from various backgrounds outside of California State Polytechnic University - Pomona. The survey item which asked about the least helpful parts of the bilingual education programs can be reworded to more accurately reflect what is being asked of the participants.

These findings contribute to the understanding of the experiences that transitional bilingual education and dual language immersion students have during the duration of their stay in these programs. From this study, these experiences can serve as examples of how the bilingual educational system can ameliorate the conditions of the programs in which students spend their many of their development years in. Future studies can use these findings as a reference point to expand this research to take into account the other various bilingual education programs that exist.

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Appendices

Appendix A: Survey Questionnaire

1) You must be 18 or older to participate in this study. Are you over the age of 18?

   a) **Yes**

   b) **No - END SURVEY**

2) What language(s) do you consider to be your native language (s)?

   -open entry/ short answer

3) What language(s) do you speak in addition to your native language(s)?

   -open entry/ short answer

4) How would you judge your proficiency in your native language(s)?

(Luo, H., Li, Y., & Ming-Ying, L.)

   a) **Beginners**

   b) **Intermediate**

   c) **Advanced**

   d) **Superior**

   e) **Distinguished**

5) How would you judge your proficiency in your additional languages(s)?

   a) **Beginner**

   b) **Intermediate**

   c) **Advanced**

   d) **Superior**

   e) **Distinguished**

6) What is your gender?

   a) **Male**

   b) **Female**

   c) **Non-Binary**

   d) **Prefer Not To Say**

7) What is your age?

   Open entry, prefer not to say

8) What is your ethnicity?

   Open entry, prefer not to say

9) What grade did you start school in the United States?

   Open entry, prefer not to say

10) Did you have any bilingual education?

11) What kind of bilingual education did you receive in school?

   a) **Transitional bilingual education (brief explanation)**

   b) **Dual language immersion (brief explanation)**

   c) **I don't know (brief explanation - if you don't know how to identity, if it doesn't fit anything but you remember having something)**

12) In what grades did you receive bilingual education?

   a) **K-5**

   b) **6th-8th**

   c) **9th-12th**

   d) **Other**

13) Do you feel more or less prepared for college due to your bilingual education?

    a) More

    b) Less

    c) Neither

    d) I have never thought about it

14) What part of your bilingual education helped you to feel the most/least prepared for

    college?

    open-entry

15) What kind of support was offered to you in your program?

    open-entry

16) Do you feel your Bilingual Education teacher was helpful during your time in the

    program?

    a) Yes

    b) No

    c) Somewhat

17) Did you learn content or language in your program?

a) Content

b) Language

c) Both

d) I never thought about it

Appendix B: Interview Questionnaire
(Conrad, 2017) Beginning of interview: Review purpose of study and confidentiality. Ask how interviewees got into TBE/DLI educational programs.

Student Questions

1. Tell me about your experience as a transitional bilingual education student/ dual language immersion student. To understand your experience as a TBE student/ DLI student, what is important for me to know?
Prompts: Amount of time spent speaking a certain language in the classroom? Types of support throughout the program? Reading preparation? Writing preparation? Were you thinking at the time how these skills will be applied to university coursework? In what way? How do you plan to use these skills for university coursework?

2. What did your day consist of while in the TBE and DLI programs? What kind of materials did you use in your TBE/DLI classes? How would you describe your classroom setting?
Prompts: how did your TBE/DLI classes differ from your standard classes? What kind of students did you see participating in the TBE/DLI classes? When and how did you begin your TBE/DLI program? How did this daily work and materials help you prepare for university?

3. What kind of learning methods were used in the TBE/DLI programs?
Prompts: Who helped you learn new concepts while in the TBE/DLI programs? What was your response to the new concepts of the TBE/DLI programs? How did the new concepts help you in your readiness for college? How has your instruction mode influenced your preparedness for college? Who influenced you in your bilingual education program?

4. If a bilingual/multilingual student asked you what they needed to know about TBE/DLI programs before joining one, what would you say?
Prompts: How did you come to know this information? Who taught you this information?

5. What ideas do you have for how to improve TBE/DLI instruction for bilingual/multilingual students?
Prompts: What experiences have helped you to learn to speak, write, and understand in your languages? What else would be helpful for me to know so I can understand your experience of being a TBE/DLI student? What would you have liked to experience to help prepare you for college?

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The Failure of LA's Great Outdoors: A Study of Park Inequity and Publice Health Outcomes in Los Angeles

Abstract

Living in Los Angeles, visiting a neighborhood park, and taking advantage of recreational space seems like a simple, uncontroversial activity. The ability to easily be in outdoor spaces is something that most will take for granted. As such, the distribution and availability of public parks is not an issue many urban dwellers think about. Yet, as with many contemporary issues in the United States, public park access highlights inequities across racial and socioeconomic lines. For lower-income neighborhoods and communities of color, park inequity is a symptom of, and the catalyst to a multitude of much larger problems. As the US's second-most populated city, one would hope that LA provides enough recreational space for all its residents. However, this thesis shows that most parks and other green spaces in LA are concentrated in wealthy, majority-white neighborhoods, leaving the remaining residents with unequal and inequitable access to what is commonly considered a public good and a human right. This creates a gap in public health, leading to higher reported rates of obesity, poor mental health, and general quality of life. Through new use of public funds, change in policy, and community-oriented design for urban parks, this inequity in Los Angeles can be a thing of the past.

One of the most significant, yet least discussed issues in the United States is public parks, and public land in general. While not a new issue, the Covid-19 pandemic has drawn more people into public parks because of isolation and quarantine restrictions. The ability to be outside in public space during the pandemic was not equally shared by all in the U.S. It would be expected that something as seemingly trivial as public parks would be plentiful in major urban centers. The lack of equitable public space is perhaps felt most severely in Los Angeles (LA), along both racial and socio-economic lines. Annually, Trust for Public Land ranks American city's park efficiency and equitable distribution on a 100-point scale. LA got 41, ranking 74th out of 100 (Simon, et. al., 2016). For a city whose civic pride runs deep, this should be disappointing. This problem is not new by any means, but in an era with increasing levels of income inequality and racial inequity, this is one area that deserves more attention and more solutions.

Unequal access to parks is not an issue unique to Los Angeles. Park equity affects many cities around the world, but the outcomes and consequences of unequal access remain consistent. Infamous for high levels of density and a shortage of affordable housing, LA's park inequity strikes at lower-income populations and has the potential to lead to severe public health disparities between groups. Though this problem has been prevalent in the U.S. for decades, growing attention on this has presented a unique opportunity to implement new, pro-park equity laws. As will be addressed in the literature review, scholars point to historical discrimination in housing and zoning, and rapid suburbanization that have created the necessary conditions for this problem to exist. Coupled with rising housing prices and increasing density of new housing stock, these factors compound on one anotherto restrict access to public space and result in disparate outcomes for public health

between communities.Those resistant to reducing park equity may say that it is obviously an issue, but not a dire one. Recent data surrounding public health outcomes relating to physical activity prove otherwise. Cardiovascular health and rates of obesity will be analyzed, as well as socio-economic stress relative to each neighborhood for this case study. By looking at these statistics in relation to public park access, this thesis can create conclusions about the research. This thesis will look at how failed public policy and poor urban design in Los Angeles have established inequitable distribution of public parks, thus leading to disproportionately negative public health in affected communities. By conducting a case study of the fifteen different city council districts in LA we can reach a better understanding of why different neighborhoods have different outcomes, and what this has to say about broader social issues.

One area regarding successful approaches to public parks that cannot be ignored is good urban design. Overall, American cities tend to be more car-oriented, leading to wide streets, expensive suburbs, and a lack of walkability for urban residents. A profit motive generally influences such policy nation-wide and Los Angeles in particular. This design of American cities has its roots in commercialization, and the ability to have a multitude of businesses and shops on a single street, where cars can slow and "window shop". The lack of human-facing design and walkability in cities is not something many think about, especially when it comes to how this affects public parks. When cities are emphasizing car usage, and actively rejecting human-scale design, this leads to suburbanization and density in urban centers. Public parks being available for every neighborhood become an afterthought when planners assume that parks can be reached by car in the suburbs. This negates the experiences and reality of lower-income neighborhoods and pretends that the socio-spatial exclusion of people of color in suburbs does not exist. To solve this, there not only needs to be better design decisions for cities, but a complete overhaul of how public policy has approached this issue thus far.

This research aims to prove that there is a specific link between lower access to public parks and lower public health as a result. Factors such as urbanization/suburbanization, housing discrimination, zoning policy, and poor design have contributed to this in their own way and come together to create lower standards of living for lower-income communities of color. The research design of this paper is a case study of four of Los Angeles' fifteen city council districts (Figure 1). The four selected cases are council districts 4, 8, 9, and 11. Looking at both public park access and public health outcomes will give an understanding of how the issue can be handled. Both similarities and differences in policy can be seen through document analysis, observation, and historical research into existing laws. Contemporary approaches to solve the park inequity crisis may not be sufficient to fully understand the cases. Historical approaches to the problem can still have ripple effects that are felt by communities today, especially regarding housing. The negative effect that redlining, suburbanization, and higher density in urban centers has had on lower-income communities of color still exist today. As such, it is important to take both historical and contemporary factors leading to park inequity into account.

The effect that these above-mentioned factors have on public health will be acquired through self-reported surveys as well as through previous research into such disparities. By understanding how exercise and recreation affect physical and mental health will create a greater understanding of why there are differences in health for neighborhoods that are park poor. By establishing that unequal access to public parks will create unequal health outcomes, this thesis can show failed urban design continues discrimination of communities of color and works to the advantage of the already privileged. Creating such a link can help inform future policy and design solutions to create more equitable and livable cities in the future. Such design solutions will be oriented around the most park-poor neighborhoods and improve access to public space for those who have been historically disadvantaged.

METHODOLOGY

This thesis utilized a case study model to analyze the inequity of public park access in Los Angeles (LA), California and how this leads to poorer public health outcomes for the affected communities. I believe that a case study is the most appropriate method for this thesis because it is conducive to in-depth policy analysis that a topic of this scope requires. Other qualitative methods such as observational fieldwork or surveys would have been insufficient to properly collect the relevant data. While this is a case study of the current inequities in public park access, historical analysis regarding housing discrimination, public land use policy, and demographic change is necessary to properly explain the context surrounding the current situation, as well to provide meaningful policy solutions. Both comparing success/failure in providing public park access and comparing public health outcomes will require historical and contemporary context to understand how widespread and severe park inequity has become.

To understand this context, historical data surrounding redlining, housing discrimination, suburbanization, and legislative information regarding public parks have been collected. Historical documents and academic research into past developments will allow for an understanding of how the access to public parks has changed and adapted over time, relative to both housing and urban expansion. Contemporary data regarding potential legislative action and current demographic and housing data has also been collected. This will provide the foundational knowledge necessary to understand the root cause of modern inequities, as well as understand park inequity as it currently exists. This portion of the study seeks to show that this issue exists along divisions of class and race. Affected communities are expected to be lower-income and have most residents who are people of color. With both a historical and contemporary understanding of the issue, the case study will compare park-poor and park-rich areas and analyze the public health outcomes of affected communities.

Categorizing neighborhoods of either "park-poor" or "park-rich" will be based on collected data regarding how close residents of each neighborhood live to public parks. The specific metric will be "number of park acres per 1,000 residents". This approach will account for the differences in population and geographical size while still maintaining a consistent analysis of overall access to public lands. These same neighborhoods will also be represented by their demographic data to provide a wider understanding of the social context within which these issues arise. While numerical data will be explored to categorize neighborhoods as park-rich or park-poor, it is necessary to categorize these neighborhoods into successes or failures to better understand which residents of LA are better served by the government, and which are less provided for.

The main areas of public health analysis in this thesis, as follows: potential years of life lost due to cardiovascular disease per 100,000 residents, potential years of life lost due to diabetes per 100,000 residents, rate of childhood obesity as a percentage of the adolescent population, and self-reported adherence to specific CDC recommended guidelines for recreational activity. These four areas can be applied to both park-rich and park-poor neighborhoods to compare the success and failure of Los Angeles in providing easy access to public parks for all of its residents, as well as compare public health outcomes relative to the availability of green-space. Through this, the human cost of public park inequity can be explored.

This case study is, however, rather limited in scope, as it will not address the quality of each neighborhood's parks, only their quantity relative to population. This, in turn, can be used to conclude whether equity of access has been achieved. There are weaknesses in this approach as neighborhoods with few parks, but of high quality, may experience a higher standard of living when compared to a neighborhood with relatively many parks but of low quality. While these are subjective measures of analysis, applying broad assumptions upon a neighborhood, their demographic make-up, and their public health has the potential to be insensitive to these residents' lived experience. In that regard, this study will not draw conclusions that intend to target specific communities, ethnic groups, or any other class of person. When analyzing public health outcomes, conclusions and policy recommendations regarding exercise and mental health will be limited to the data provided and will not draw upon social stigma, assumptions, or stereotypes for any class of person. Given the subjectivity when measuring quality of life, this study seeks only to compare the availability of public parks and draw conclusions surrounding public health in the most objective way possible for the author. This study also relies heavily on the assumption that easy and equitable access to public land is a human right. As such, policy recommendations and proposals will seek only to expand that right to as many LA residents as possible.

Another limiting factor of this study is the low level of external validity. Given the focus on Los Angeles for this case study, solutions, policy recommendations and park design proposals will be specific to LA. This does limit the ability of this study to apply to other cities, especially in different US states or countries. However, the issue of park-inequity, especially long divisions of class and race are not unique to Los Angeles. There is potential for transferring some of these recommendations and conclusions to the broader context of global inequities in public access to parks; adjustments will need to be made to fit each country, city, or community.

LITERATURE REVIEW

A plentiful amount of research exists regarding public parks, their distribution, and their effects on public health. Analyzing the history of Los Angeles' relationship with public parks throughout its expansion can help create a broad understanding of how the problem has been exacerbated to its current level. Many scholars agree that there is a significant link

between health and exercise (Wolch, et. al., 2011). Studies into mental and physical health outcomes in relation to recreation and exercise have found a positive link between the two. Crucial to addressing this link is not only relying on individual responsibility to pursue a healthy lifestyle, but for the government to provide adequate opportunities for its citizens to engage in recreational activity to increase overall public health outcomes (Bedimo-Rung, et. al., 2005). Therein lies the issue of this thesis: the provision of such public space. Decades of housing discrimination and urbanization have left LA in a unique position of having significantly less park space in the areas that are the most vulnerable and in need. Even in park-poor neighborhoods, the design of what little public space available to them, leaves much to be desired. Scholars have shown that a broad lack of access to public parks falls not only on class divisions and socio-economic status, but on race (Boone, et. al., 2009). Literature on urbanization and suburbanization show that public policy regarding this issue, Prop 13, Prop K, the Quimby Act, and more, have failed to adequately solve this issue, thus leaving countless LA residents without easy access to public parks.

Historical and Modern Context of Public Parks in Los Angeles

When analyzing the literature surrounding inequity of LA public parks, the city's history with housing discrimination and expansion are inextricably linked to park distribution. This expansion relative to planning and other developed cities is explored in Kushner's A Tale of Three Cities: Land Development and Planning for Growth in Stockholm, Berlin, and Los Angeles. While many European cities engaged in urbanization through expanded social housing programs and creating dense but socially sustainable cities, LA's urban growth was intertwined with post-war suburbanization (Kushner, 1993).

In the aftermath of World War II, the population of Los Angeles increased dramatically, with more GI's returning to the United States to build a family. This was paired with a new influx of Mexican American workers moving to Los Angeles to seek jobs in a city growing with post-war industrialization. With migrant families entering a predominantly white urban space, the families of white veterans left and sparked rapid suburbanization in a phenomenon called "white flight" (Schneider, 2008). Scholars point to this as a turning point in LA's ability to provide equitable public goods for all its citizens. The most notable impact of white flight was the capital that left with the white, middle-class families (Robbins, 2020). As the wealthier, middle-class families left, so did the financial resources that they carried with them. This led to a quick decline in infrastructure for urban areas that were now dominated by minority populations. As redlining became common practice under the government sponsored Home-Owners Loan Corporation, many Latino and African American families were denied access to these newly developed suburbs. With no social mobility to help them escape lower-income communities, these people were stuck. This becomes relevant to parks when recognizing that funding for public parks can be tied to property value and the associated taxes. Literature in academia largely agrees that since minority populations were essentially forced into lower-income areas, the funding necessary to build new parks would never have arisen (Perry & Harshbarger, 2019). When important goods like public parks, education, and infrastructure spending is often tied to property values, the relatively wealthier white families leaving the growing urban centers left poorer immigrant families with less revenue to sustain their neighborhoods (Robbins, 2020). This serves as a foundational point in park inequity. The original division between urban and suburban

neighborhoods grows along racial, ethnic, and socio-economic lines and only worsens as this problem continues.

Modern Housing

With the new influx of non-white immigrants into Los Angeles, came more housing developments in the city center near job opportunities. With less capital than the new suburbs, these urban neighborhoods were mostly multi-family development units and housing complexes rather than single-family homes. While they were able to improve the efficiency with which people could be housed, it created one of the more significant barriers to public park creation: density (Carliner & Marya, 2016). A combination of less tax revenue resulting from white flight, and the sheer number of people that were coming into LA necessitated the construction of massive amounts of housing. Wherein potential residents of color were systematically excluded from majority white suburbs and pushed into denser communities of color concentrated in urban areas (McConnel, 2013). This acted as modern-day segregation, establishing racial covenants in the suburban areas that could enjoy the benefits of historically higher tax revenues and the public amenities that came with it. The remainder, and the majority, of LA residents constituted a lower tax bracket that was unable to secure more funding for public goods and services as their white counterparts.

The housing crisis does not only affect a small minority of people. It impacts those along every aspect of society. Even middle to upper class residents feel the effects of rising housing prices and low housing stock. Though those already vulnerable and disadvantaged feel the effects the strongest. The most visible of these populations are people experiencing homelessness. On this point there is relative agreement among scholars: homeless populations face perhaps the greatest hurdles in attempting to access housing (Urban Institute, 2007). The numerical lack of affordable housing, temporary housing, or direct government assistance for them is of course a factor in their obstacles, though this exclusion occurs at all levels of access. "Sociospatial exclusion" is a term coined by Von Mahs in his writing: Down and Out in Los Angeles and Berlin: The Sociospatial Exclusion of Homeless People (Von Mahs, 2013). The idea represented by this term is consistently expressed throughout the literature on affordable housing even if not by name. Centered on three main points (legal, service, and market exclusion), it encompasses the rejection of homeless people from society and relegates them to a cycle of poverty, while simultaneously excluding them from access to socio-economic opportunities (Von Mahs, 2013). While the ability for homeless residents to find housing is an issue that deserves more devoted study, this shows a lack of support for the most vulnerable populations. Scholars point to these failures to provide basic necessities for citizens as a cause of park inequity by excluding homeless people from the market and society at large.

A contemporary analysis of LA's housing market also shows little promise in providing equitable outcomes for public land use, which is inextricably linked to housing. Scholars seek to evaluate the LA housing market to determine factors influencing housing prices as well as provide policy recommendations to improve the situation, with special regard to public park distribution. The significant influences on price were found to be restrictive land use regulations, historical segregation, and high marketization; all of which will be discussed further in this thesis. Most low-income households, disproportionately people of color or

people with disabilities, were either cost-burdened or severely cost-burdened (Gibson, et. at., 2019). Many of those low-income households were at risk of displacement or homelessness. This lack of adequate housing left them with a shortage of tax revenue necessary to fund public parks, coupled with a lack of municipal interest on the issue due to high density developers would face. Policy recommendations were increase the affordable housing stock (particularly in communities of color), preserve current affordable housing stock with rent control measures, prevent the displacement of low-income and middle-income households, ensure and expand access to protected classes of people, and to increase community integration to combat segregation (Wolch, et. al., 2005). By addressing these core issues of housing and risk of homelessness for at-risk communities, expanded access to public parks would ensue in the form of neighborhood development.

Modern Zoning

Academia agrees that historic discrimination in housing have significant and wide-reaching impacts on disadvantaged populations' ability to access public space to the same degree as more privileged groups. Today, Los Angeles still contends with the aftermath of its discriminatory housing practices of today, however the effects still have far reaching consequences. With the city being divided into fifteen city council districts, each one represented by a city councilmember voted in by the residents of each district, there is much room for political interference when trying to create equitable cities.

The restriction to public parks begins at the highest level of government in LA, appearing in more subtle forms than the out-and-out racism of redlining and former policies of housing developers; it takes new shape in zoning laws. Exclusionary and inclusionary forms of zoning impact urban design in ways that uphold forms of discrimination in public park access. Zoning specifically for industrial and business centers are disproportionately placed in lower-income neighborhoods of color. While residential and recreational zoning too often is for more white, suburban neighborhoods. Scholars conclude this to be a form of environmental racism (Mukhija, et. al., 2010). By restricting access to more environmentally friendly and health-friendly zoning, people of color and lower-income families are relegated to living near industrial plants and multi-lane highways that increase their exposure to harmful chemicals and will potentially lead to harmful health effects that this paper will explore more in-depth. This is in stark contrast to more wealthy and traditionally white neighborhoods that have been zoned for residential developments. By being more environmentally and health-friendly, these neighborhoods are saved from harmful exposure to waste and toxins from industrial sites and heavy-traffic roads and highways.

On the opposite side of municipal zoning, Mukhija and other authors seek to analyze if inclusionary zoning is an effective and efficient method to increase the ability for housing policy to improve access to public parks. They conclude that it is not statistically significant in improving affordable housing stock or park access, mainly due to in-lieu fees (Mukhija, et. al., 2010). These fees have been addressed by many authors and are when developers may pay a fee to the government rather than be required to build several affordable units or a set number of park acres. This undermines the city's efforts to provide affordable housing. Given the small effectiveness of inclusionary zoning on lowering housing prices (but not to the level of median affordability) it should be a part of a comprehensive housing strategy,

not the only policy action taken. Singular actions cannot improve access to public space by way of affordable housing since the issue intersects multiple areas of municipal governance, a multi-faceted approach to address this problem must happen, and zoning policy is a foundational step towards that. As such, these are not only zoning problems that lead to less access to green space and therefore poorer public health, but academic literature further ties this to the idea of poor urban design playing a role here. The design of urban spaces is dictated by municipal zoning. The problem of public park access cannot be adequately addressed until zoning laws change in favor of people-oriented design and open up traditionally disadvantaged communities to more environmentally and health-friendly zoning, such as public parks.

Enacted Policy Concerning Public Parks

The above factors: suburbanization, urbanization, density, and housing discrimination, and poor zoning, all contributed to the inequity of public parks by creating the modern housing crisis. Coupled with failed public policy to rectify the problem, the housing crisis has partially led to a severe lack of public space, especially for low-income communities of color. There's been a multitude of policy approaches to attempt to solve this issue. However, few have made a positive impact. One such approach is to increase affordable housing through a voucher program called Section 8. Scholars cite Los Angeles' Section 8 voucher program and changes to zoning laws as solutions to the housing crisis, and by extension the public park crisis. While marginally successful, Section 8 has been unable to meet the rising demand for housing, especially when accounting for the Covid-19 pandemic. With a waitlist that is thousands of applicants long, there is no viability for Section 8 for someone in need of emergency housing or on the verge of homelessness. Kurwa focuses on the idea of voucher programs being renter centric (Kurwa, 2015). This scholarship seeks to examine how tenants from low-income neighborhoods integrate socially and economically into middle-income suburbs through the Section 8 voucher program. These tenants generally experienced social exclusion and racial discrimination both socially and through attempts at gaining employment, causing them to eventually withdraw from the community. Being geographically far from employment opportunities limited economic mobility. Kurwa concludes that the limits of Section 8 translate geographic rental opportunities into social and economic integration, severely limiting the ability to provide effective and gainful affordable housing in Los Angeles County. By denying meaningful access to affordable housing, even in traditionally suburban spaces, scholars conclude that access to parks can never be achieved for a wide range of the citizenry (Loukaitou-Sideris & Stieglitz, 2002). Developers are required to build a certain number of affordable units in new developments, but this small number of homes is incapable of meeting demand when relying solely on market forces (Kurwa, 2015). Rising construction costs, pandemic related work slow-downs, and loophole fees that can be paid in place of building affordable units and park space all negate this as a viable solution to the crisis. When analyzing loopholes that emerge with housing and park developments, scholars point to the Quimby Act as a clear hurdle to achieving equity.

The Quimby Act was passed by the California State Legislature in 1965 and was enacted in 1971. It required housing developers to build a park or recreational space within 2 miles of the development or pay a fee in lieu of building the park (Woloch et. al., 2005).

In theory, this would create more equity distribution of parks and help these communities. However, it disproportionately advantaged the white-dominated suburbs. Property developers were only building new apartment complexes and new housing developments in the suburban areas where they could charge higher rent. So, they were free to just pay the "in lieu" fees and avoided having to build new parks altogether. Even when there were new housing projects being built in urban spaces, it was easier to avoid setting aside land in already dense areas by just paying the fees. The "in lieu" loophole allowed for this problem to worsen since more and more urban developments lacked recreational space.

Proposition K is another significant contributor to park inequity in Los Angeles. Prop K is a 1996 property tax that sets aside funds to be given out through an application-based grant for the sole purpose of funding public parks (Woloch et. al., 2005). The main issue with this is its ease of access. Lower park equity areas generally do not have very robust community-based organizations (CBOs) and lack the resources to adequately apply for these grants. The system favors higher-income areas with more social capital and more influential CBO's that annually apply for these grants. Those areas already have expansive public parks, so most Proposition K's funds are not being used to build new parks, but to improve existing ones (Woloch et. al., 2005).

The most scholarly debate surrounding park equity is surrounding Proposition 13. Prop 13 mainly limited property taxes in the state of California. Passed in 1978, it froze the tax rate for any property built that year or before. The only way for those property values and their associated taxes to be reassessed was if they changed hands. This disadvantaged newer communities that were sprouting in the city and allowed more wealthy residents with deep familial roots to benefit from lower taxes. So, how does this affect park access? In an episode of his podcast Revisionist History, Malcolm Gladwell addressed this very issue. While not a piece of scholarly research, the inclusion of park inequity in popular media is guided by shifts towards equitable solutions within academia. He points the blame towards one of LA's bedrock institutions: private golf clubs (Gladwell, 2017). All the golf courses in Los Angeles take up roughly 2,300 acres, most of which is empty greenery with few people utilizing it (DiMauro, 2016). Despite their prevalence and associated wealth, their property tax is stuck at the 1978 level, all because of Proposition 13. Gladwell points out that despite new members being added to golf clubs on a regular basis, the city does not count that as a change in ownership (Gladwell, 2017). Therefore, the property tax rates of these clubs are never reassessed, creating a massive amount of private land that is exclusive to a small class of people (Gladwell, 2017). These clubs only pay a fraction of what their "true" property tax should be when adjusted for decades of inflation and increased property values. This leaves inner-city communities near these clubs left with a small tax base to support the already scarce parks.

Public Health and Exercise/Recreation

Research in academia finds a clear link between exercise and positive effects on an individual's health. There is ample scholarship addressing this issue directly. What is specific to this thesis is the correlation between municipal provision of public parks and public health outcomes. However, the broader context surrounding public health policy regarding recreation and exercise is necessary to form a complete understanding of why

improving park equity should be at the forefront of policy maker's minds. Looking at children in particular, studies have demonstrated that there was a significant increase in extracurricular physical activity at both educational and neighborhood settings when the opportunities were accessible (Wolch, et. al., 2011). Children often take advantage of these opportunities on their own accord when they are there. Such recreational activities led to reduced levels of childhood obesity, cardiovascular complications, and overall health outcomes for the participating neighborhoods. Research has demonstrated that in-school and after-school programs that provide opportunities for extracurricular physical activity increase children's level of physical activity and improve other obesity-related outcomes (Wolch, et. al., 2017). While this is a study limited to the effects of recreational activity on the health of children as it relates to school and neighborhood-based programs rather than municipal intervention, the evidence holds that higher access to recreational opportunities will lead to better health outcomes overall. Scholarship even points to solutions addressed in this thesis as influencing one's health. Characteristics of the built environment have been shown to support physical activity if they are created with good design principles in mind (Coen & Ross, 2006). Multiple design strategies that are implemented in public spaces aim to increase physical activity through changes in the built environment itself. Scholarship points to specific principles that can be utilized by planners to improve access to park-poor neighborhoods with the expressed interest of increasing positive health outcomes (Coen & Ross, 2006).

The most significant purpose of these studies was to increase the percentage of residential areas that have easy access to recreational spaces. The role that urban design and municipal planning had on communities' ability to engage in recreational activity is significant. The negative health effects that come with this lack of access implores that the scholarship continues to grow on how to better solve this issue. (Kakietek, et. al., 2009). Further scholarship concurs on this topic: one of the most significant problems in the United States is the rise in childhood obesity, and that access to public space plays a role. The CDC states that roughly 18.5% of American children are considered obese and the number is only rising (Hales, et. al., 2010). Given the severity of this issue it is worthwhile to appreciate the effect that park access has on this. A study by the University of California, Los Angeles found that adolescents between the ages of 12-17 living in areas with a high concentration of poverty in their neighborhood experienced a significant decrease in physical activity, especially when fewer parks were near them (Figure 2). Similar patterns of physical activity were found when analyzing adolescents aged 12-17 but qualifying for the unemployment rate (Figure 3). As with neighborhood poverty, children's physical activity decreases. Other studies have analyzed a much larger sample size, Los Angeles County, finding near identical results (Wolch et. al., 2011). The scientific studies clearly show that more access to public parks and recreational space will help lower rates of childhood obesity. The wealth of literature on this topic is not divided about the root causes of inequitable public park distribution, nor the effects that little recreational activity has on public health.

PUBLIC PARK DISTRIBUTION IN FOUR OF LA'S DISTRICTS

Los Angeles - A Broader Perspective

In conducting this study, the demographics, park acreage, reported public health outcomes, and socio-economic factors were collected for each of Los Angeles' City Council Districts, and the city. By establishing a baseline of data for LA as it compares to other comparable American cities, a much more comprehensive analysis of the districts within LA can reveal the extent to which public parks are equitably distributed, and the effects this distribution of parks has on public health. Being able to compare LA to other cities in the U.S. is necessary to establish context that this issue exists. While this thesis' focus is to compare the neighborhoods and districts within Los Angeles, policy recommendations can be applied to all cities within which this problem exists. Therefore, understanding LA's unique version of a much larger problem will highlight past mistakes and conscious exclusions that must be recognized to solve this problem moving forward. Including demographic and socio-economic data allows for broader conclusions about contemporary discriminations of race and class to be made. These can be recognized and incorporated into policy recommendations for planners and designers.

Los Angeles has a population of roughly 3,966,366 as of 2019 and it's expected to grow by roughly 8.1% between the years of 2020 and 2030. This growth is expected to happen in the areas of the city that are already the most dense; Downtown LA, South LA, Echo Park and Silverlake. It's also expected to come primarily from migration rather than birth. For decades, LA has consistently seen large influxes of migrants from Latin America, the cultural influence this has had on the city has also helped create a strong sense of civic identity and pride among residents. (LACDPH, 2016). Younger people are also rapidly moving to urban areas in search of jobs, leading to increased housing prices due to higher demand. As of 2019, the largest demographic in the city is Hispanic, 48.5%. Latino residents are not only the majority, but they are also growing at the fastest rate (LACDPH, 2016). Also trending upwards is the number of undocumented residents moving into Los Angeles. This number has been steadily increasing for decades and is predicted to continue. From a socioeconomic perspective, the average household income for the city of Los Angeles is $62,142 (LACDPH, 2016). While this seems to be close to the national average, exorbitantly high incomes for a small minority of LA residents tends to increase the average. Most residents live in dense areas that are overwhelmingly poorer than the few neighborhoods in LA that drive the average income higher. Similarly, the surrounding area of LA county has a higher average income at $68,044. Average household income is only one data point, it already hints to broader inequalities that are systemically built-in to the way that LA has developed throughout decades.

As for public parks, approximately 23,938 acres (8%) of total land in the city's borders are for parks or other land uses. When adjusted for the population size, that is 6.2 park acres per 1,000 residents. Broken down into simpler terms, that is roughly 1 park per 10,000 residents. (LACDRP, 2020). As mentioned above, this number includes private parks as well, as a considerable amount of park acres in Los Angeles are devoted to private clubs that exclude most of the city's population from their use.

When looking at the distribution of the parks in relation to household income and levels of poverty, the difference is staggering. Areas with a median household income of over $40,000 and less than 10% of residents below the poverty line can enjoy between 18-21 park acres per 1000 residents (LACDPH, 2016). Areas with a median household income

between $20,000-$30,000 and between 20-40% below the poverty line have access to only 1 park acre per 1000 residents (Wolch, et. al., 2005). These numbers show that the vast majority of LA's green space and public parks fall in areas that have more money, while neglecting lower-income neighborhoods. These statistics are very similar when classifying park acres according to race instead of income. Areas where over 75% of residents identify as Caucasian can enjoy 31.8 park acres per resident. Looking exclusively at children, that increases to 192.9 park acres per 1,000 children (Wolch et. al., 2005). Areas that are predominantly Caucasian have an overwhelming majority of the green space in Los Angeles. A common sight to see are suburbs with vast tree coverage while urban areas have little in the way of greenery. In communities where over 75% of residents identify as Latino, African American, or Asian-Pacific Islander (API), those numbers reduce to anywhere between 0.3-1.7 park acres per 1000 residents and 1.6-6.3 acres per 1000 children. Areas with the least number of parks are API and Latino communities, with African American communities only barely increasing their acreage by roughly 1. 9% (Wolch et. al. 2005). To simplify the data above, when looking at the city as a whole and not breaking it down to districts, most of the public parks are in the richer and whiter areas of the city. Previous research has shown that LA's parks have always been distributed this way, but the continuation of this injustice is something that can be avoided.

Urban density and suburban sprawl play a big role in defining where these parks are. As LA's population grows, there is an increase of people moving to already crowded neighborhoods in the inner-city areas. The less dense and more spacious suburbs are secluded by a wall of high property prices. Urban density highlights both class struggle through property values but also racial disparities. Communities of color are in the inner-city urban areas with less physical space but a much higher density, 2-5 times denser to be exact (Wolch et. al., 2005). White-dominated neighborhoods are in suburbs with more open space that can be developed into parks.

LA City Council District 4

District 4 covers some or all the following neighborhoods: Koreatown, Mid-Wilshire, Miracle Mile, Fairfax District, Hollywood Hills, Sherman Oaks, North Hollywood, Cahuenga Pass, Los Feliz, and Silverlake. It is also home to many of LA's most popular tourist destinations including Hollywood Boulevard, Griffith Park, the La Brea Tar Pits, The Los Angeles County Museum of Art, the Grove, and the Hollywood Bowl. The sheer number of tourist attractions is significant because this turns D4 into one of the highest earning economic zones in LA. The economic prosperity felt by the businesses and residents in this district will have significant impacts on the availability of public parks and green space as that is all funded by tax revenues. It's important to note the socioeconomic status and demographics of this district. Essentially, who is benefiting from tourism and how is that benefit affecting access to public parks? On the council D4 is represented by Councilmember Nithya Raman, and has a total population of 260,788, notably lower than the other high park density area, District 11 (LACDPH, 2018). When compared with previous years, the population growth in these higher earning economic zones trends with previous research showing the highest levels of population growth in more dense areas of the city. Most of the population is white: 63.1%. Regarding the age of residents, most residents are between 18-64 years old (LACDPH, 2018). This category of people is extremely likely to

take advantage of public spaces. Within this age range could be parents utilizing parks for their children, young adults seeking recreation, or recent retirees just trying to get out of the house. The fact that much of the population is within this category means that a lot of park space is going to be needed.

The median household income of D4 is $42,760, much lower than the city's average. In line with the lower average income, 12.9% of residents have had an income in the last 12-months that was below the poverty line (LACDP, 2018). Given that this district has very high tourist areas, the lower average income can seem like an anomaly, but it can be explained by the geographic location and the zoning of the district. This area is traditionally much more urban and has a lot fewer suburban areas. While most citizens still live in single housing units, that's because of the high rate of renter-ship in these urban spaces, rather than ownership of single-family homes. The zoning of the district matters here because less space is zoned for residential lots, leading to a higher density of housing units, and a much higher level of business and recreational space. However, this recreational space is not entirely public parks, but rather is taken up by the many high profile tourist attractions that were mentioned above. It may seem that D4 is more economically successful because of these high prosperity economic zones, but those revenues don't necessarily go to the residents, but the business' shareholders. One aspect of D4's economic prosperity that can be felt by the residents is the property tax revenues that come with these tourist attractions. Seeing as how property taxes directly fund public parks, both in construction and maintenance, higher levels of park distribution in comparison to the other districts is expected.

Looking at its acreage of public parks, D4 has 16.8 park acres per 1,000 residents. This is four times larger than the next closest district, but still only half of the highest performing areas, District 11. This points to the exponential difference in available park space in D11 and D4. Given that the urban density of D4 is like districts closest to the urban center, it suffers from a lack of available space to build parks. This is counteracted by two combined forces: its location on the edge of the city, and the tourist/recreational destinations not accounted into traditional park acreage. Despite its density, most of the residential neighborhoods lie near the edge of the district where more space becomes available for parks to be constructed. The denser areas of D4 largely comprise the tourist destinations that can even be enjoyed by residents as recreational spaces. These two forces create a unique situation in D4 wherein it is just as dense as park poor neighborhoods, yet its residentially zoned areas are located to where they are spared the negative effects of this density while still enjoying the economic benefits that come with it.

Given its high level of park distribution, D4 is expected to see similar levels of compliance with CDC health recommendations, premature deaths to cardiovascular disease, premature deaths to diabetes, and rates of childhood obesity that were seen in D11. This is consistently seen in D4's public health outcomes. D4 has the exact same percentage of residents who meet CDC recommendations for physical activity, 42% (Kakietek; et. al., 2009). This low percentage relative to the high level of access to public parks can be attributed to broader social and cultural trends in the United States regarding physical activity (Kakietek, et. al., 2009). Residents also have significantly lower levels of premature death and rates of obesity when compared to other districts and the city.

Per 100,000 residents, there are 473 years lost to premature death caused by cardiovascular disease, and 66.7 years lost to premature death caused by diabetes. Rates of childhood obesity are also far less prevalent than in more park-poor areas (LACDPH, 2018). At only 22.2% it is not the lowest of the districts studied in this thesis, or of all districts, though it is far less than areas with a much lower level of public park access.

LA City Council District 8

The second most park poor district within Los Angeles is LACD 8. This area encompasses most of the South LA neighborhood and is currently represented by Councilmember Marqueece Harris-Dawson. D8 has a population of 252,296, with most of its residents identifying as Hispanic: 56.66% (LACDPH, 2018). There is also a much higher percentage of black residents in this neighborhood in comparison to the other cases for this study, and for other districts in the city: 39.96%. When comparing that to the most park rich districts of 11 and 4, the percentage of the population that identifies as black is very close to the population of D8 that identifies as white: 1.77%. These racial differences across neighborhoods do have historical roots in redlining and housing discrimination, and the systemic discrimination that has created this lack of diversity among neighborhoods and the intentional creation of racial enclaves to protect white residents. The age of the residents in D8 are also closer to other park poor districts analyzed in this study, with the majority of the population, 63%, staying between 18-64 years (LACDPH, 2018). The age of residents is particularly significant in park poor districts because of the reasons mentioned above.

District 8 also has a considerably lower average household income in comparison to the citywide average. At $31,539, this is only slightly higher than half the average. Combined with the increased household size, urban density from compact housing, and rate of poverty, D8 has poorer socio-economic conditions in the specific areas that will impact the funding for new or updated park spaces (LACDPH, 2018). As such, it is expected that there will be lower park acres available to the residents in comparison to the citywide average and the best performing districts. D8 has a drastic drop in available park acreage per 1,000 residents at 0.53 (LACDPH, 2016). Compared to D4, the difference is staggering. Urban density in this area is like that of D4, yet the access to public parks is massively reduced. Density is not the only predictor though. While it is certainly an influence, there are other consistent trends that are much better predictors of park availability.

Regarding public health, only 42% of LACD 48's residents meet the recommended guidelines for physical activity as laid out by the CDC (Kakietek, et. al., 2009). Per 1,000 residents, LACD 8 experienced 1199.1 years of potential life lost due to cardiovascular disease, 318.1 years of potential life lost to diabetes, and had a childhood obesity rating of 35.5% (LACDPH, 2018). This trends accordingly with the other districts analyzed in this thesis. And it goes along with the expected trend of higher rates of potential life lost and other public health outcomes when controlling for the acres of park access. Overall, there are massive disparities in the availability of public parks and recreational spaces when, and these differences can be best seen when comparing the most park-rich city council districts: 11 and 4, to the most park-poor: 9 and 8.

LA City Council District 9

District 9 encompasses the majority of South LA and the western portion of Downtown LA. It is also home to attractive tourist destinations, similarly to District 4. Within its boundaries lies LA Live, the Staples Center, and the Los Angeles Convention Center. It is represented on the city council by Councilmember Curren Price, and has a total population of 285,373. The overwhelming majority of the population is hispanic at 79.18% (LACDPH, 2018). Before analyzing the other aspects of this study, the difference in population demographics shows a very different neighborhood than in the districts that are park-rich. In contrast to these park-rich areas, the white population is only 3.19%. The age of D9 residents is also slightly different than the previous districts. The most important change in the age of these residents is the proportion of those 0-17 years old, which increases to 30% (LACDPH, 2018). This makes D9 unique in that it has a very high population of younger people, who traditionally rely heavily on public space. While of course the other age groups take advantage of public space, there is a special importance for younger groups when looking at public health. This carries with it heavy implications given that this is also the most park-poor of all LA City Council Districts.

D9's population is also affected by broader trends in migration that are felt by the city as a whole. Migration patterns show large influxes of hispanic families, predominantly in areas that already suffer from urban density. Most likely this is because of the prevalence different Latin American cultures have in these areas, with deep roots and strong connections that incentivize new residents to move where they feel most welcomed. This creates a feedback look of new residents moving to already dense areas while pseudo-ethnic-encalves are formed in richer suburban areas that exclude inner-city residents from utilizing the park space afforded to them through higher property values and increase socio-economic power. The average household income in this district is $26,300, which is far below the city's average. There is also a much higher rate of poverty with 34.6% of residents earning an income in the last 12-months that was below the poverty line (LACDPH, 2018). There are many factors that lead to lower-income communities sprouting in cities, though, the major historical trends discussed in the literature review establish the foundation for lower economic standing. Modern problems such as no policy change for housing, a lack of social safety nets, and little municipal investment lead to lower quality homes that are far more dense. All these issues leave the community with a smaller property tax base to fund much-needed parks. Denser areas like D9 have extremely limited space and with less economic incentives that are seen in places that have better accessibility to parks. These areas are also unlike D9 in that they have more single-family homes and fewer multi-family homes that do not have as high of a property tax base. Such areas are left with little to no funding for park space.

In terms of park distribution, Council District 9 is the most park-poor, performing far worse than the most park-rich and even the average for the city. Per 1,000 residents, D9 has 0.33 park acres (LACDPH, 2016). The availability of park space for residents in this district is astronomically reduced compared to other areas. This disparity has a multitude of implications for those living there. Given the demographic make-up of the area, this continues historical and contemporary injustices through planning and design of urban spaces. Through this, the areas with the lowest amount of park space have the highest ratio of people of color living there. The higher rates of poverty and poorer socio-economic conditions of these areas also differ significantly to what was seen in D11 and D4. The continuous discussion around urban density plays a significant role when analyzing the level of park poverty, however it is also relevant to address the different policy decisions that have contributed to this. As mentioned in the literature review, the Quimby Act, Prop 13, and other acts limit the availability of parks in lower-income areas through restrictive policy (Robbins, 2020). The most significant hurdle to constructing new parks in these neighborhoods is tying park funding to property tax, inherently limiting the available funds. Whether it is through in-lieu fees or capped property tax, there is a structural hurdle imposed onto lower-income neighborhoods that does not exist for higher-income areas.

District 9 also performs considerably worse across all public health measures. Only 32% of residents meet the CDC's recommended guidelines for physical activity (Kakietek, et. al., 2009). There are still national trends and social norms that affect this measure, however, the difference between districts is still significant. The lower levels of adherence to CDC's recommendations can be attributed, to some degree, to the lack of public parks available to these residents. On other public health measures, D9 performs in a similar capacity. Per 100,000 residents, there are 1027.3 years of life that are potentially lost due to premature death due to cardiovascular disease, and 235.7 lost to premature death caused by diabetes. There is a higher rate of childhood obesity in this area as well, 33.3% (LACDPH, 2018). The difference between park rich districts and park poor districts in these categories is exponential. There are far higher rates of premature death and negative outcomes in park poor districts.

LA City Council District 11

Out of the fifteen city council districts that comprise the city, one stands above the rest with a significantly higher results on all measures. District 11 covers some or all the following neighborhoods: Brentwood, Del Rey, Mar Vista, Marina del Rey, Pacific Palisades, Palms, Playa del Rey, Playa Vista, Sawtelle, Venice, West Los Angeles, Westchester, and LA International Airport. It is represented on the city council by Councilmember Mike Bonin and has a total population of 266,594. Most of the population is white: 62.2%, this is far higher than the average proportion of white residents for the city (LACDPH, 2018). This dichotomy in racial identity between District 11 and LA is relevant to the distribution of public parks when recognizing the role that historic discrimination in housing development plays in determining where public funds are spent. Demographic differences between districts are an important determinant when looking at park distribution to recognize larger social issues. When compared to the city's data, District 11 is home to a slightly older population with 15% of residents being 65 and older (LACDPH, 2018). D11 also has a significantly higher population of white residents in comparison to other districts and nearby areas outside the city such as in LA County. The significance of this racial difference shows that racial enclaves within the city exist and have outcomes that vary significantly from neighborhoods and districts who are more diverse in all demographic categories.

The median household income of D11 is $71,420. Contrasted to the city's data, D11 has significantly higher percentages of residents that make above the total average income, as well as very few residents that qualify as lower income. Only 8.8% of D11 residents had income in the past 12 months that was below the poverty level (LACDPH, 2018). When combined with the information that roughly 70% of residents have household sizes of one or two persons, the data clearly shows that D11 is more economically successful and less dense than the city or other districts. The household size is indicative of single-family homes and suburban zoning, both of which are conducive to higher levels of park acreage as opposed to areas with higher household size, leading to higher zoning density.

Public Park access in D11 is overwhelmingly higher than any other district in LA. D11 leads all 15 districts with 35.10 park acres per 1,000 residents (LACDPH, 2018). When looking only at LA's city average, this is a staggering number. When compared to the cases for this study, D11 has almost double the park acres of the next closest area whose residents enjoy 16.8 acres (LACDPH, 2018). These numbers trend even higher than Wolch's findings in a study showing that neighborhoods with lower socio-economic performance have between 18-21 park acres per 1000 residents (Wolch et. al., 2005). D11's performance was far higher than in the estimates by Wolch's study. With the average income of D11 being relatively high, the park acreage trended upward with it. (Wolch et. al., 2005). Historically, the neighborhoods comprising D11 have been majority white, upper-middle class, and single-family zoned. The collected data tracks well with historical trends and shows the link between these demographic and socio-economic facts, and park acreage.

When looking at D11's performance regarding public health measures, its much higher than other districts. Per 100,000 residents, D11 has 379.5 years lost to premature death caused by cardiovascular disease, as well as 54.3 years lost to premature death caused by diabetes (LACDPH, 2016). For the prevalence of childhood obesity, D11 had a percentage of 19.9%. These numbers are considerably lower than most of the districts in Los Angeles. When coupled with the high volume of park acres available to each resident, the link between these becomes clear. However, only 42% of residents meet the CDC's recommendations for recreational activity (Kakietek, et. al., 2009) Relative to the easily available public parks, this number seems low on the surface. Other factors may be contributing to this, such as higher average age, the emphasis on car-based cities opposed to walkable cities, and average levels of recreation at the state and national level may all be contributing to lower rates of recreational activity. While it is outside the scope of this study, these factors should be touched upon. Despite that low percentage point, it is still contrasted by more positive performance data in the other two public health measures.

NEQUITY IN LA - CONCLUSIONS

It can be concluded that there is a relationship between the demographics and socio-economic conditions of city council districts and the equitable distribution of public parks and recreational spaces. As such, this causes a significant difference in the reported outcomes for these neighborhoods' public health. This inequitable access to public spaces only continues the discrimination and systemic racism that has historically affected LA's neighborhoods.

Comparing the four cases chosen for this study, the most amount of public park and recreational space per district is in District 11 (Figure 4). Looking individually at these measures of predicted park access, racial make-up of city council districts is quite a strong predictor. Between the two most park-rich districts, there is not only an increased population of white residents, but specifically the ratio of Hispanic residents decreases. Going from 19.1% in District 11 and increasing to 79.18% in District 9 shows a clear racial disparity between areas with high access and low access to public spaces (Appendix 2). There is a strong link between the racial make-up of these districts and the predicted availability of parks. There is also a negative relationship between the average household income within each district and the availability of public parks. As the average household income increases, so does the amount of park acres per 1,000 residents. The inverse is true as average income decreases. Coupled with the varying demographics between cases, it becomes clear that most public parks in Los Angeles are concentrated in the whiter, wealthier neighborhoods, while the poorer communities of color lack the same access to green spaces.

The relationship between race, wealth, and parks has drastic effects on public health as well. In the areas where there are less park acres, the number of years lost to premature death in every analyzed category increases. The inverse remains true for areas with a higher acreage of parks. There is also less adherence to CDC recommended guidelines for recreational activity in the spaces with less parks. The reasoning behind this does not reflect attitudes or cultural differences within the communities, but a lack of access because of municipal failure. The disparity in health is clearly linked to a lack of recreational facilities, which is compounded by poorer economic conditions for said residents. The design of parks in areas like D4 and D11 also differ dramatically. Park-rich districts with more funds to construct and maintain parks have access to trails, exercise equipment, and sports facilities. This is not always true for the park-poor districts. It is more common to see smaller parks with less capacity to provide recreational equipment and exercise space. By not providing the necessary space, equipment, and park quality, designers and planners are exacerbating these public health disparities. This connection is not a recent phenomenon, but a continued cycle of systemic discrimination that has its roots in red-lining and racially motivated housing policy of the late 20th century. Policy decisions that limited the economic opportunities for communities of color restricted the supply of funding for public parks and de-incentivized local officials from investing there. While rooted in past injustices, the continuation of such inequity is a problem that can be solved today.

Policy recommendations to begin remedying this problem are simple: the correction of past mistakes that continue the discriminatory practices of the past century. Policy approaches to solving park equity have been discussed for many years in California. Recently, the 2020 election in California included one proposed measure to repeal Proposition 13, but this initiative failed. Passing such a measure down the road could reinvigorate Los Angeles' tax base by requiring higher income neighborhoods with higher property values to pay a fairer share of taxes. More property tax income for the city would allow for higher investment into lower-income communities that are desperate for park development. The Quimby Act and Proposition K have also received heightened public attention regarding their effect on park inequity. For Proposition K, the prospect of repealing the measure seems unlikely. A more plausible solution is to establish more robust and

politically powerful community-based organizations in poorer neighborhoods. Doing so would allow them to better apply for park project grants under Proposition K. The Quimby Act could be easily amended to close the "in lieu" fees loophole. Requiring new housing developments to include recreational space, instead of giving them an option to opt-out for a fee, would essentially force development companies to address park inequity. On a much broader scale, decoupling park funding from property tax would go a long way towards reducing the prevalence of park-poor neighborhoods in Los Angeles. Allocating funds on a need-based system rather than property values ensures that parks are built where they should be.

Aside from policy approaches, one of the most common solutions to park inequity is to simply build more parks. Perhaps the most important impediment to remedying inequity is the lack of space for potential parks. Especially in Los Angeles, the neighborhoods that are most affected by park access are denser than others. As previously stated, inner-city neighborhoods are 2-5 times more densely populated than suburban neighborhoods (Wolch et. al., 2005). Since these neighborhoods desperately need more public parks, new solutions to the land issue need to be created. According to Alessandro Rigolon, the three most important issues when trying to decide where to build new parks are proximity, acreage, and quality (Rigolon, 2016). The easiest to combat is proximity. If the goal is to provide green space close to underdeveloped areas, then smaller parks with less amenities can be built into housing developments, or in small residential lots that have been abandoned (Rigolon, 2016). While this leaves much to be desired in terms of quality, it nicely solves the issue of proximity. Acreage and quality go hand in hand as the harder of these three issues to solve. In dense urban areas, residential lots are not large enough to accommodate sports fields or large recreational areas. One solution proposed it to build near transportation hubs such as bus stops or metro lines, or near stormwater infrastructure (Rigolon, 2016). These commonly have open space to accommodate parking and other municipal functions. However, this solution is double ended as it solves the problem of park equity but exposes residents to potentially hazardous emissions from stormwater and heavy traffic from public transportation.

This problem will never be completely solved, the allocation of public space is ever-changing and always necessary. Further research for this issue is needed to design specific parks for neighborhoods in need, both within Los Angeles and all urban spaces. This thesis has served as a foundation of research analysis into four city council districts of Los Angeles to analyze how well these areas perform in providing public parks and promoting public health. As such, the full extent of this issue in LA has not been reached. To that end, more scholarly research should address the past inequities that are continued today by ineffective policy and failed design to promote an equitable future for all residents of Los Angeles.

APPENDIX:

1.) Does Design Matter?

Discussing solutions to park inequity will inevitably lead the conversation to the topic of design. There are many designers who have been inspired to end park inequity and have created designs for new parks unique to Los Angeles. Three such designs that seek to reimagine the city's current infrastructure and make it more accessible and park friendly. The first proposed plan is the Los Angeles River Revitalization Master Plan (LARRMP), seeking to utilize the waterway as a public good through multiple different projects. One is The Albion Riverside Park (Figure 5) would provide open green space and multiple sports fields to the communities near Dodger Stadium and Lincoln Heights (Reyes et. al., 2007).

Another project is the Taylor Yard G2 River Park Project (Figure 6). While the Bureau of Engineering has three proposals under this project, the most promising one is an island project. It seeks to completely overhaul how the Los Angeles River is used in the Cypress Park neighborhood, an area that is relatively park-poor. It would establish a pseudo-island in the river that would be connected on either side by tree-filled parks with bike paths for recreation.

The third prominent solution to park inequity in Los Angeles has to do with the heavily trafficked 101 Freeway. The group named "Friends of Hollywood Central Park" has developed a plan to construct a 38-acre park on top of roughly 1 mile of freeway, named Park 101 (Figure 7) (Barragan, 2014). As of 2020, the plan has gone silent and seems to be no longer in progress (Sharp, 2017). The details of the dead proposal still give powerful insight to what can become of Los Angeles if given the proper attention.

Running from Santa Monica Boulevard to Bronson Avenue, the park would bridge the division that runs through Downtown Los Angeles, arguably the area that experiences the most amount of park inequity (Barragan, 2014). This plan would provide much needed green space to the residents of DTLA.

2.) Demographics: Los Angeles City Council Districts

This data was collected from the 2020 Los Angeles Citywide Census and is supplemental. Its purpose is to provide a broader context for the inequities discussed in this thesis, and to show the disparities that occur relative to the racial make-up of each neighborhood.

Racial Make-up: Los Angeles City Council Districts

LA City Council Districts	% White	% Hispanic	% Black	% Asian	% Pacific Islander	% Native American
1	9.20%	69.5	2.5	17.6	0.2	0.2
2	42.9	43	4.6	6.7	0.1	0.2
3	44.8	36.4	3.9	11.7	0.01	0.3
4	60.9	14.5	4.4	16	0.1	0.1
5	68.1	11.2	3.1	13.3	0.2	0.1
6	18.4	66.7	3.2	10	0.1	0.2
7	22.3	66.8	3.1	6.3	0.1	0.2
8	2	52.2	41.7	2.1	0.1	0.1
9	2.1	79.9	15.7	1.5	0.1	0.1
10	10.2	44.1	28	14.7	0.2	0.1
11	60.1	18.7	5.2	11.6	0.2	0.2
12	47.7	28.1	4.3	16.4	0.3	0.2
13	25.6	51.1	3.6	17	0.2	0.2
14	13.6	68.1	4.2	12.4	0.1	0.1
15	18.5	60.7	11.9	5.9	0.4	0.2

Residents' Age: Los Angeles and Selected LACDs

	% Aged 0-17	% Aged 18-64	% Aged 65 and Older
LACD 4	16	70	14
LACD 8	26	63	10
LACD 9	30	64	6
LACD 11	17	68	15

3.) Figures and Images:

Figure 1:

Figure 2:

Figure 3:

Figure 4:

Figure 5:

Figure 6:
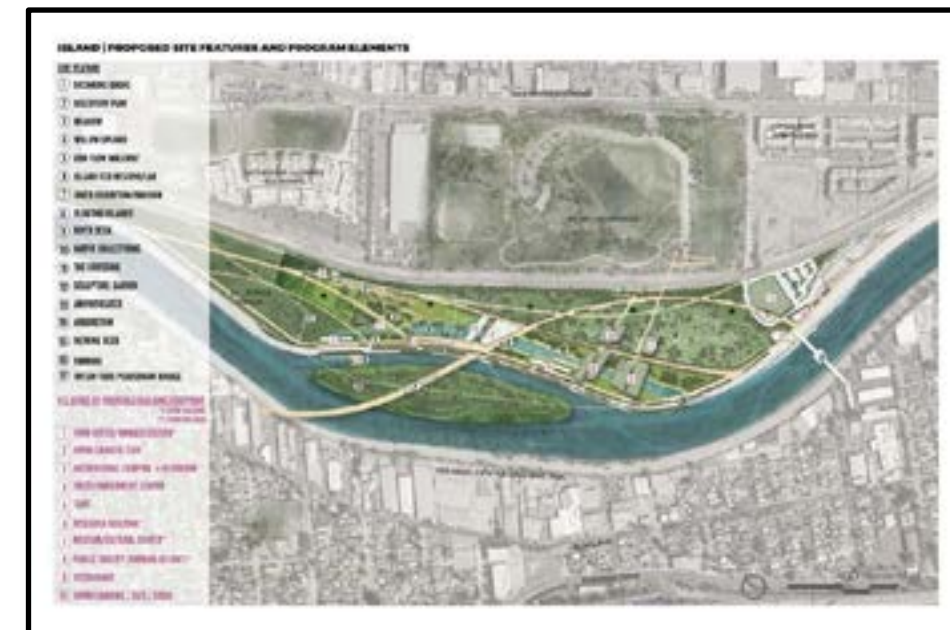
Figure 7:

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Climate Change in California

Climate Change in California

Ashton Kozloski, Niko Lau, Katelyn Pham, Cristina Perez Rodriguez, & Kalen Villarosa

Abstract

Climate change in California has taken a toll on its environment through warmer temperatures, wildfires, and droughts. Our group was researching and wondering how climate change was so frequent in California and what can be done to reduce it. We narrowed the source down to transportation, electricity, and industry to conduct our research on. Thus, we formed a poll questioning the people of the world and later generated a set of solutions for this problem.

Introduction

Climate change is prevalent issue that stemmed from the Industrial Revolution and continues to affect us all globally as humanity advances to make our lives more comfortable. It is the accumulation of overwhelming amounts of emissions produced by transportation, electricity, industry, agriculture, and commercial/residential uses that heats up our Earth, causing catastrophic weather changes. Out of these, transportation, electricity, and industry contribute to nearly 75% of all greenhouse gas emissions (Environmental Protection Agency 2021). If these three sectors' emissions are limited, so will their effects on the climate. Some solutions have already been created, such as the Caltrans project to increase public transportation, reducing the burning of fossil fuels from industry by using less material to construct vehicles, and using fuels that are more sustainable (Incentive Technology Group 2020).

Future Directions

By purchasing fuel with lower carbon intensities, such as renewable natural gas and low-carbon biofuels, rideshare, and bicycling. In addition, using electric or hybrid automobiles provides lower carbon or non-fossil fuels. Also, reducing the amount of travel and adapting to minimize fuel use can help lessen carbon dioxide. These solutions will reduce the burning of fossil fuels and the damage in the atmosphere that is causing climate change.

Methods

We conducted a survey about climate change and people's awareness to the problem. The questions were: Where are you located? Are you worried about or do you care about climate change? How often do you use a long-distance commuting vehicle? (ie: cars, not walking or skating)? Are you aware of the amount of carbon dioxide produced when types of transportations are used? If so, what are you doing? Do you have any opinions or things to say about climate change? We received 61 responses in the survey. We used online scholarly sources and sources the librarian recommended.

Conclusion

The evidence is clear and people have voiced their concerns. Climate change is a daunting subject that seems to loom too large for anybody to feel their actions can make a change. But we learned that we are the ones who can make the changes necessary to see a cleaner Earth.

Climate change is a real and serious threat our generation faces. Change is hard but climate-friendly choices are easy. Making smarter choices in regards to our non-recyclable consumption, maintaining efforts to keep our carbon emissions low, and educating those around us who do not understand their impact are all essential to restoring our planet. We are the generation inheriting this planet, so it's up to us to be the ones to make it better.

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Landin
Zane   **The United States Should Adopt a Universal Healthcare System**

Introduction and Thesis

According to the World Health Organization, universal health coverage is people having access to the health services they require, ranging from prevention to rehabilitation, which will be afforded to them despite their socioeconomic status. There are many different countries that provide its citizens universal healthcare. Some popular examples of universal healthcare can be seen in Canada and Switzerland. Over the last few decades, there has been a huge flux in healthcare costs that are skyrocketing more than the average person can afford. Health insurance premiums have been increasing over the past few years. From these inflated costs charged from health insurance providers, more Americans are currently uninsured. The United States Healthcare system is primarily interested in increasing profit margins; this is especially shown when insurance is covering millions of dollars in medical expenses with no transparent reason or explanation for these substantial costs. This issue with people being neglected by a lack of health insurance usually affects low-income citizens and disadvantaged groups, but there is a growing trend of millions of hard working, middle-class Americans left uninsured. Healthcare is one of the leading financial causes of bankruptcy in America. The United States is known to be one of the richest countries in the world, but is neglecting its citizens by not providing a basic form of universal health coverage. 28.5 million people in the United States do not have health insurance. Among people who do have health insurance, 67.2% have private insurance while 37.7% have government-provided coverage through programs such as Medicaid or Medicare. Employer-based health insurance is the most common type of coverage, applying to 56% of the US population. The lack of health insurance is an injustice that continues to be established in the United States. A form of universal healthcare would undeniably create a healthier society, and help citizens protect and care for their own health. Therefore, the United States should adopt a universal healthcare system where everyone should be given access to a basic form of healthcare.

Current American Healthcare System

A universal health insurance system would guarantee that all citizens will be able to access health insurance. Before the Patient Protection and Affordable Care Act became part of the law in 2010, there were millions of Americans left uninsured. Even with the Affordable Care Act in place, millions are still uninsured. The best way to describe the United States Healthcare system would be classified as a hybrid model. The totality of the United States Healthcare system consists of employment-based insurance; Medicare which is a government program that covers almost everyone over the age of 65, Medicaid and SCHIP, individually purchased private insurance, and CHAMPUS, VA, and Military. The United States has a blend of private insurance, employee-based insurance, and governmental coverage. The hospital industry was once run by religious organizations with a good intent wanting to provide services to patients. They had a social good vision from the beginning. During the 1960's, Medicare came around and was covering hospitals bills and payments. Then in 1980 most people that were under the age of 65 were covered. This led to more revenue generated, and many people were no longer paying most of their medical bills with

their own money. With this financial influx from health insurance, changes were being made from the way money will be used and how patients will be charged. Doctors were advised instead of focusing on the best way to treat their patients to the best, optimal way to bring in more revenue. Health insurance was transformed from a provider to a business model that only strived to bring in the most revenue, which is why executives and doctors were given an incentive to stick to this model by providing them with high-earning salaries that very much contradicted their platform being a non-profit service. The industry doesn't necessarily care for the patients that cannot afford it. The model encourages the insured who bring in the most money to be provided with the best care, and the uninsured weren't aided.

The Current View of Universal Healthcare

The problem with health insurance in the United States is that it is being treated as a privilege and not a necessity. Health Insurance is treated in terms similarly to the myth of the American Dream, indicating that individuals who work hard and maintain economic stability have righteously earned their coverage. It isn't being recognized as a right that should be afforded to everyone despite their socioeconomic status. The United States already provides free public education, public law enforcement, and many other public services. Healthcare should be added to this list. Currently, there are many presidential candidates running for the 2020 election that are shifting the conversation about universal health care in the United States, and bringing light to the issue. There is a large chunk of the United States population and powerful politicians that believe that the government should not play a role in providing health insurance, they believe that responsibility falls on the individual. Many people believe that the United States Healthcare System is a private insurance system. This is not necessarily true, since 84 million people currently benefit from governmental health coverage from Medicare, Medicaid and the VA, that is 28 percent of the population being covered by governmental insurance programs.

The Current State of Affairs with Healthcare

The average American is in favor of a form of universal healthcare system. Most people will argue that the current healthcare system in the United States is messy, and needs a major reform. Based on a study done at Harvard University, "a lack of insurance is associated with as many as 44,789 deaths per year." Thousands of people are dying, because they are uninsured. This is an important reason to issue a mandated universal health coverage, because United States citizens are dying because they are uninsured. One could argue that driving and enlisting in the military can also result in death and that is unjust. The difference is engaging in activities such as being part of the military or driving already presents a level of danger, whereas healthcare does not. This is an argument for the current system, because people are solely dying from being uninsured. The United States should not be putting its people in a position where they could possibly die, because they are uninsured. In the United States, people are 33% less likely to have a regular doctor, 25% more likely to have unmet health needs, and over 50% more likely to not obtain needed medicines compared to their Canadian counterparts who have a universal right to healthcare. Healthcare is a first part of the issue when it comes to basic needs for people in the United States. The access and equal opportunity to healthcare will not solve underlying problems that are preventing opportunities. The next would be things like adequate, healthy

food and better education. Although universal healthcare would primarily help with the people in the United States, it would also support other areas like the economy, public health, and businesses. It would help with public health issues, because there have been cases where people can't get the help they need. It would help with economy, businesses, and entrepreneurship, because it would help businesses, since they wouldn't have to be paying for healthcare for employees.

The Right to Healthcare

The right to healthcare is one of a set of international agreed human rights standards, and this implies that the different states under the international community should provide a basis of health coverage for its citizens to protect their human rights. On Dec. 10, 1948 the United States and 47 other nations signed the United Nations Universal Declaration of Human Rights. The document stated that "everyone has the right to a standard of living adequate for the health and well-being of oneself and one's family, which includes medical care. The people of United States do not have a right to be healthy since the right to health is immeasurable, but they should be offered the opportunity to healthcare. Also, in 2005, the United States and the other member states of the World Health Organization signed the World Health Assembly resolution 58.33; which stated that everyone should have access to health care services and should not suffer financial hardship when obtaining these services. Looking at how the international community approaches health coverage, it nicely lays out the idea that the government should be protecting freedom and the pursuit of happiness. If someone is uninsured and does not have access to healthcare, this blatantly goes against what the United States initially agreed upon. The people of the United States cannot be given the right to be healthy, because there are some people who will never be healthy. But everyone should have the right to attain the healthiest they could possibly be with healthcare and resources.

Health is of Special Moral Importance and Rawl's Theory of Justice

Norman Daniels a famous philosopher states that there are three pertinent questions that need to be addressed to fully understand what justice requires of health and healthcare. Daniel's argues that health is of special moral importance, because health encompasses various opportunities for individuals to live in a just society. But why exactly is health of special moral importance? The reason why health is given a special privilege over other rights is because, it extends those other rights. An example would be that if someone is sick, they are going to have a harder time working, using transportation, focusing, and being engaged. Health can be a contributing factor or a detriment to people's other rights. The access and equal opportunity to healthcare is the first step to build a society that protects people's basic liberties.

These questions can be answered by looking at Rawl's theory of justice fairness. Rawls argued that in a just society basic liberty are being protected, there is fair equality of opportunity, and limiting inequalities to those that benefit the worst off. Rawls never regarded health in being included in the basic principles that are needed in a just society for all. His original theory only assumed that people were never ill and lived full lives. The extension of this theory including health as a basic liberty is what makes the theory more

plausible and practical. Therefore, Daniel's extends Rawl's theory. He begins by defining why health is of moral importance. If health is extended as a primary social good, would that solve everyone's health? Promoting and protecting health is important, because if we have an obligation to protect liberty and basic rights, then that would include health. If Rawls's theory is correct, then this extension would allow an objective framework of well-being that will include health needs and permits the idea that we are obligated to protect opportunity and provide healthcare to everyone in America. Also, part of Rawl's Theory is the idea of the veil of ignorance which states that if people were to come together to decide on what these basic liberties are, they would decide what those are based on what they personally would like to be afforded. The people deciding would not be biased in their decision making, they would need to decide on what rights they would be afforded despite who they are or how they currently live. Looking at the veil of ignorance, it seems plausible that people would want to be helped if they are hurt or sick, and that would apply to healthcare services.

Universal Healthcare Model

What would a universal healthcare system look like? The three important aspects in a universal healthcare system are equity, quality, and cost-effectiveness. These are three important qualities for an effective universal healthcare system. Currently, two universal health coverage is being discussed. These are the single-payer system and the regulated market system.

Single-Payer System

A single-payer system is when the government owns the entirety of the health insurance. If someone under a single-payer system goes to see a doctor, the government will be paying the doctor. There are some Americans who do not believe a single-payer system would ever work, but there are examples of government insurance programs like Medicare that are benefitting millions of people. Looking at Bernie Saunders, his famous idea for universal healthcare is "Medicare for All." He is proposing a single-payer system to be implemented. It would cover many things such as: "primary care and prevention, inpatient care, outpatient care, emergency care, prescription drugs, durable medical equipment, long term care, mental health services, non-cosmetic dental services, substance abuse treatment, chiropractic services, and basic vision services." The costs are reduced in a single payer system. Canada has a single-payer system and their spending is $2,233 less per person than in the United States, but it would greatly increase government debt, which is where disagreement comes from. People don't want the entire government to take control over the private insurance system. But with the single-payer system, private insurance can still be made available. If someone wants to purchase additional insurance that is not covered at the base government coverage, they have the complete freedom to do so. These seem like great reasons for the United States to adopt the single-payer system, but it does include some concerns worth noting. The money from the single-payer system needs to come from somewhere, and the primary solution would be to create a separate new, healthcare tax, or increase taxation already from the progressive tax method. Since everyone will be receiving treatment, the wait times could massively increase, and it could make it even harder for people to get covered. Another reason could be that some people deal with harsh conditions where the single-payer system may not be enough, so they

would have no choice in having to purchase more health insurance on top of the single-payer system.

Regulated Market System

The second method that the United States could implement would be the Regulated-Market System. How it would work would be that the government would release vouchers for every citizen to take to any private-insurance company that they would like. They cannot be denied the insurance plan, because of how much money they make. It would be included in the voucher. The private insurance would help the individual in developing a medical plan that will cover their healthcare needs. They would be allowed to go to any private insurance company being served in their general area. In opposition to the single-payer system, this would allow citizens to freely choose what private health insurance they would want. This method also work well with how the United States has set its enterprise with free markets. It gives consumers the range and freedom to decide how they will be covered. There needs to be a basic health plan, because that would allow the private insurers to cover what they want, but in a universal healthcare system, there needs to be a basic coverage that all the private insurers need to follow. These basic health benefits will be directed and implemented based on Congress. These basic plans will cover when someone goes to an office visit, hospitals, prescription drugs, minor dental care, mental health care, and physical/occupational therapy. The two main things for this system to be possible would be to eliminate Medicaid and Medicare, and adjusting premium subsidies to ensure that health insurance is affordable to everyone. A huge problem with the regulated market system is that it limits choices for low socioeconomic communities living in rural areas. Their options will only be available between 2 to 3 private insurance providers.

Conclusion

There many different countries currently providing its citizens a form of universal health coverage. There are solid reasons why the United States should implement a universal healthcare system. The overwhelming majority of people are in favor of it, it would support and boost the economy for employers and businesses, it would help people who are uninsured who have severe medical conditions, and it would create a better society. Thus, the ethical questions remain in what is the best method, how will it be accomplished, what is the best cost-effective method, and how is the government held accountable so that it will properly serve its citizens?

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Landin **How can Innovative Technology be Leveraged to Support and**
Zane **Address Mental Health?**

Objective

To better understand how professionals in medical fields are utilizing technology to address mental health. More specifically, I will evaluate the practicality and impact mental health care app's have in addressing the gap between accessibility to professionals, and the lack of seeking out help due to stigmas. There are many companies already creating projects with advanced technology to help people. What hasn't been done yet is looking across the board with many companies and literature on what works and what doesn't. The objective of this research project is to first gather to analyze and look at trends of different innovative companies, applications, clinicians, and practices that are utilizing technology to support and address mental health. This project is important, because we are in a time where people are not being treated for their mental health solely because they cannot afford, stigma, or they do not have insurance. This is to help the people who need the help. This paper is to address resources that already exist that are helping people.

Background/Problem

The term electronic mental health (e-mental health) refers to the use of the internet and related technologies to deliver mental health information, services, and care. The use of online interventions for the prevention and treatment of mental illness is one of the major applications of e-mental health. There is strong evidence to suggest that these e-mental health interventions are effective for use in the management of mild to moderate depression and anxiety. It can be disseminated in the primary care setting. Research in public health and psychology has expanded on the issues associated with mental illnesses in the United States.

The benefits to e-mental health are that they are convenient, flexible, because they can be accessed anytime and anywhere, and material can be reviewed as often as required. They have low or no service cost to patients – many interventions are free, although related costs such as mobile data or internet download limits should be considered. They fill service gaps, because they can introduce therapy, or an alternative for people averse to face-to-face treatment. This can save practitioners' time, allowing mental health professionals to focus on patients for whom e-mental health approaches are not appropriate, thereby reducing wait lists. It is inexpensive to deliver and can be disseminated to large populations.

Not only is mental health stigmatized but the research also shows that not everyone has an equal access to mental health care. People do not have access to their psychologist all the time. Millions of people in the United States that do not have equal access to mental health care. The mental health care gap is extraordinarily large, and many people are being underserved. Mental health is the main disability for adults and mental health care treatment is a continuous treatment. According to the 2017 National Council for Behavioral Health report, the number of practicing psychiatrists is declining, and by 2025, the demand may exceed supply by 6,090–15,600 psychiatrists. What can be done to serve people's mental health if there is a decline in psychiatrists?

In recent years, developers, researchers, and medical professionals have attempted to address some of the aforementioned issues by creating what they hope to be accessible and easy to use phone applications. For example, (Woebot is a phone app that includes these features: Think through situations with step-by-step guidance from Woebot using methods from Cognitive Behavioral Therapy (CBT), learn about yourself with intelligent mood tracking, and get over 150+ evidence-based lessons, exercises, and stories from our clinical team.

However, there are many people working on this solution creating phone apps to address the issue, but we are still not at a level where it can entirely replace traditional mental health care or even come close to mimicking it. But there are many phone applications that have been successful, and I am looking at what bridges them all together, and further analyze what features work best to address E-Mental Health.

Research Questions

There are many questions that need to be asked when tackling this topic. My main question is how can we improve access for e-mental health resources and are the current resources promoting access? This paper is a compiled list of different resources that someone can use if they are looking for e-mental health resources.

Methodology

My methodology consists of meta-analysis to determine the direction passed research has examined. I gathered different research from already existing companies, applications, and startups that have conducted research, and developed applications to assist users with their mental health. I achieved this using Google Scholar and ProQuest to locate the e-mental health applications. The data I've collected did not bias against my thesis. Many of the applications lack research because they are relatively new.

Mental Health Resources (Data)

Anxiety Reliever

Anxiety Reliever is an app that enables users to track anxiety symptoms and provides relaxation exercises. A limited version of the app is available for free and the full app can be bought.

Audience: Teens, Parents, Adults, Men, Women, Veterans
Price: Anxiety Reliever is free to download but with a $5.99 per month fee to upgrade.
Website Link: https://www.anxietyrelieverapp.com/

Website Link: https://www.anxietyrelieverapp.com/

AnxietyCoach

Anxiety Coach is a self-help app that addresses fears and worries using CBT strategies. The app walks you through making a list of feared activities and helps you master them leading to less fear and worry. The app includes tools for a severity self- test, making a plan, anxiety tracking, and viewing your progress.

Audience: Teens, Parents, Adults, Men, Women, Veterans

Price: $4.99

Website Link: https://apps.apple.com/us/app/anxietycoach/id565943257

Breathe2Relax

A simple, intuitive, and attractive mobile app designed by the National Center for Telehealth & Technology to teach breathing techniques to manage stress. The skills taught may be applied to those with anxiety disorders, stress, and PTSD.

This app can be personalized to a pace that the user finds relaxing; includes a video demo, reading materials, and charts to map personal progress. Helpful for self-starters or those working with a therapist to include breathing techniques in their overall treatment.

Audience: Teens, parents, adults, men, women, veteran

Price is free

Website Link: https://apps.apple.com/us/app/breathe2relax/id425720246

CPT Coach

This is targeted at individuals with PTSD who are in active treatment with a trained CPT (cognitive processing therapy) therapist. Designed to be used by the patient in concert

with CPT treatment, this app offers a great deal of education about PTSD symptoms and a step-by-step, session-by-session approach to following the assessments that correspond with each of week of CPT treatment. The variety of possible prompts and reminders, from scheduling appointments to reminders for homework, add an additional layer of important structure and predictability often required with treatments for PTSD.

Audience: Teens, parents, adults, men, women, veterans

Price is free

Website Link: https://mobile.va.gov/app/cpt-coach

Happify

Happify is a self-guided app that aims to increase positive emotions through exercises and games supported by positive psychology and mindfulness research. An initial questionnaire is used to suggest "tracks" for an individual's use, and subsequent activity content is geared towards various aims such as reducing worry, building relationships, increasing fitness, or coping with chronic pain. Activities are backed up with a blurb about research or scientific rationale that the user is encouraged to read. It is free with paid upgrades.

Audience: Teens, Parents, Adults, Men, Women

Price: $10.99-19.99

Website Link: https://www.happify.com/

Headspace

Targeted to anyone who wants to learn meditation to reduce anxiety and stress and improve their attention and awareness; good for a beginner to establish a regular meditative routine. The skills taught include mindfulness and cognitive diffusion, breathing exercises, meditation practice, tips for increased relaxation, concentration; may be applied to anxiety and depressive disorders, PTSD, and OCD, especially in conjunction with a health provider. This app does a terrific job of describing basic concepts with a creative animated interface, presenting meditation in a user-friendly way with clear instructions; creating an online forum; supplying podcasts; normalizing mind-wandering; and illustrating main points with videos. This app is not intended as a treatment substitute for those with serious anxiety and related disorders or depression.

Audience: Teens, adults, men, women, veterans

Price: Free for first 10 sessions only

Website Link: https://www.headspace.com/headspace-meditation-app

iCBT App

The iCBT app provides a platform to identify, appraise and reappraise negative thoughts. Users are prompted to identify negative thoughts, rate their negative feelings, and identify cognitive distortions. It can be used as a standalone self-help app, however, because there is not psychoeducation or rationale provided, background knowledge in CBT or therapist-assisted delivery are recommended for it to be effective.

Audience: Teens, Adults, Men, Women, Veterans

Price: $5.00-$9.99

Website Link: https://adaa.org/node/2731

Live OCD Free

Designed for CBT treatment of OCD with different sections for children and adults. It includes standard and user-designed exposures, ERP (exposure response prevention) exercises, a cognitive toolkit, and ERP reminder, and an ERP guide with custom and standard ERPs.

Another strength is the support of both direct and loop tape exposure (via microphone). The ERP module is almost entirely behavioral, without using possibly useful cognitive tools. Duration of ERP exercises is determined by time but not by decrease in anxiety levels.

Audience: Adults and youth with OCD Price:
Free

Website Like: http://www.liveocdfree.com/

MindShift

Targeted to help adolescents, teens, and young adults gain insight into and basic skills to manage their symptoms of anxiety disorders, including GAD, social anxiety, specific phobias, and panic attacks. It's also useful for managing worry, performance anxiety, test anxiety, and perfectionism. The skills taught may be applied to individuals with physical, emotional, cognitive, or behavioral manifestations of anxiety, providing users with more helpful, balanced ways of thinking about feared situations.

It does a terrific job of readily offering lists of active coping strategies tailored to the type of anxiety and a variety of methods to manage anxiety; the information and strategies are simple and clear. "Chill out" tools such as breathing exercises, mental imagery, and mindfulness strategies are provided in text and audio format. "Quick Tips" are included to assist with anxiety in the moment. Users can "favorite" the methods that work for them. It is not helpful for people looking to track their symptoms and progress, those easily overwhelmed by many choices, or those with posttraumatic stress disorder (PTSD) or obsessive-compulsive disorder (OCD).

Audience: Teens, parents, adults, men, women

Price is free

Website Link: https://www.anxietycanada.com/resources/mindshift-cbt/

MoodKit

This app will help individuals with depression, anxiety disorders, anger management issues, etc. The skills taught include self-monitoring, identifying and changing unhealthy thought patterns, and engaging in mood-enhancing activities.

It does a terrific job at making some of the general concepts of CBT available for people to work on by themselves or with the aid of a therapist. It would not be helpful to those with moderate to severe depression.

Audience: Teens, parents, adults, men, women, veterans

Price: Under $4.99, no subscriber fee

Website Link: https://www.thriveport.com/products/moodkit/

MoodTools

MoodTools is a self-help app targeting depression. It provides psychoeducation about risk factors and psychosocial approaches to treatment, a depression symptom questionnaire (PHQ-9), a thought diary, a suicide safety plan, and videos such as meditation guides.

Audience: Teens, Adults, Men, Women, Veterans

Price is free

Website Link: https://www.moodtools.org/

Panic Relief

This app is targeted to help individuals with panic disorder access easy-to-use, empirically supported coping tools to better manage and move through panic attacks.

The free version includes access to progressive muscle relaxation of the arm skill, while the upgrade allows access to the rest of the skills, including square breathing, diaphragmatic breathing, and progressive muscle relaxation.

Audience: Teens, parents, adults, men, women, veterans

Price: Free version and $0.99 for upgraded version

Website Link: https://apps.apple.com/us/app/panic-relief/id649055083

PE Coach

Designed for individuals with PTSD, specifically those working with a therapist using prolonged exposure (PE) treatment. The skills taught include education about the treatment, and common reactions to trauma, and breathing retraining.

Not useful as a self-help treatment for PTSD; to get the most out of it, individuals should be in therapy.

Audience: Teens, parents, adults, men, women, veterans

Price is free

Website Link: https://mobile.va.gov/app/pe-coach-2

PTSD Coach

One of two self-help apps from the National Center for PTSD, this app is targeted to help individuals suffering from PTSD, as well as those simply interested in learning more about this disorder. The skills taught may be applied to individuals with mild to moderate versions of PTSD and for whom self-guided assessment and treatment might be sufficient. It is not recommended for PTSD sufferers who require one-to-one treatment, high-frequency direct clinical interface, or for those who have difficulty make safe decisions.

It does a terrific job of education, assessing PTSD, and offering easy to understand tips to manage common PTSD symptoms, and finding additional treatment resources with providers via a search function.

Audience: Teens, parents, adults, men, women, veterans

Price is free

Website Link: https://mobile.va.gov/app/ptsd-coach

Sanvello

Targeted to help those with anxiety and mood disorders and stress, this app teaches deep breathing, behavioral exercises, excises and identifying cognitive distortions (negative thinking patterns) and learning how to replace them with positive thinking patterns. It's also good for those experiencing bouts of anxiety between treatment sessions.

The app does a terrific job of personalizing one's cause of anxiety using voice recordings and introducing CBT and reinforcing exercises between therapist appointments. This app is designed to be used in conjunction with therapy, not as a substitute for professional treatment.

Audience: Teens, adults, men, women, veterans

Price is free

Website Link: https://www.sanvello.com/

Self-Help Anxiety Management

An app to help you understand what causes your anxiety, monitor your anxious thoughts

and behavior over time, and manage them through self-help exercises and private reflection. The app is targeted to older teens and adults with anxiety disorders. The skills taught may help those with good insight and self-awareness.

Audience: Teens, adults, men, women, veterans

Price: Free

Website Link: https://apps.apple.com/us/app/self-help-for-anxiety-management/id666767947

Brain HQ

BrainHQ is a cognitive training web platform with mobile apps available for Apple and Android devices. BrainHQ comprises 29 exercises, which target six areas of cognition: Memory, Attention, Speed, People Skills, Navigation, and Intelligence. The program's exercises aim to address each category and adapt to users' skill levels. BrainHQ provides users with feedback about their progress and allows them to keep track of their scores over time and in comparison, to other users. A single group repeated measures design was used to evaluate change in balance, depressive symptoms, and global cognition in a group of cognitively impaired older adults, following 10 weeks of cognitive training through BrainHQ's web-based platform. Depressive symptoms significantly improved between baseline and 10 weeks. Mean global cognition also improved across the study period, but neither of these improvements were statistically significant. Finally, balance improved in 4 out of the 5 measures, though none were significant. One RCT found reduction in depressive symptoms in the 'Double Decision' brain training arm. Another RCT found the arm which completed 'Double Decision' training was less likely to experience depression in a one-year follow-up. A third RCT found that those who received 'Double Decision' training were 30% less likely to exhibit clinically significant increases in depressive symptoms 1 year following training.

Website Link: https://www.brainhq.com/?utm_source=google&utm_medium=cpc&utm_campaign=brand&utm_content=46467711%2B327060831330&utm_term=www.brainhq.com&gclid=CjwKCAjwgbLzBRBsEiwAXVIygHUwgyJqAQ1NIMAryrhd9FU4KI2JsLosqpb-yo7vBSedthAW6MMJJxoC2YsQAvD_BwE&v4=true&fr=y

T2 Mood Tracker

Helps individuals track their emotional states and how they change over time for personal insight and accurate reporting to a mental health professional. The skills taught may be applied to individuals with depression, anxiety, stress, trauma-related feelings, any other self-identified emotional states, as well as Traumatic Brain Injury (TBI), chronic pain, customizable for sleep and other issues.

A graphing feature allows visual feedback for long time periods. Few to no interaction or "coaching tips"; links are not useful.

Audience: Teens, parents, adults, men, women, veterans

Price is free

Website Link: https://apps.apple.com/us/app/t2-mood-tracker/id428373825

What's My M3

Your M3 score is a number to help you and your doctor understand if you have a treatable mood disorder. You can monitor your score to see how your mental health is changing over time. This app is targeted to help individuals rate various symptoms of mood disorders to determine the impact it may have on their functioning. This app may help those with major depression, bipolar, anxiety disorders and PTSD quickly determine if they need to speak to their primary care physician about a possible mental health condition that needs treatment.

Audience: Adults, men, women, veterans

Price is free

Woebot

Woebot is an AI-powered chatbot that guides users through the management of distressing thoughts and feelings using principles of Cognitive Behavioral Therapy (CBT). The app operates like a social messaging application and invites users to communicate with Woebot by sending text messages.

Upon first using the app, Woebot asks how the user is feeling, and what is going on in their life. Woebot also informs the user about how Woebot works and informs users that the app works best if the user can "help Woebot learn" by completing daily check-ins for two weeks. Then, Woebot responds by prompting with tools, skills, and strategies by inferring the users' most immediate needs. Users also have the option to toggle "SOS" mode, wherein Woebot will offer emergency resources. Woebot is not designed to be used in an emergency, or to manage psychiatric crises.

A 2017 clinical trial of Woebot found that participants who interacted with Woebot for two weeks (up to 20 sessions) showed a significant reduction in symptoms of anxiety compared to a control group of participants directed to read mental health self-help material. The study was designed to be a feasibility study for the potential of intelligent conversational agents in the management of depression and anxiety.

Audience: Children, adults, men, women

Price is free

Website Link: https://woebot.io/

This Way Up

This Way Up is a web-based program that provides information and skills for overcoming anxiety and depression. With clinician-assisted, self-help, and school- based-prevention modules, This Way Up can be used by many different kinds of users who need help to cope with symptoms of depression and anxiety. Based on the principles of Cognitive Behavioral Therapy (CBT), This Way Up may be particularly useful for individuals who do not have affordable or accessible mental health services in their area.

The following is a very small sample of the published research presumably about this product (not all studies specifically reference the name of the product). This Way Up was designed by the Clinical Research Unit for Anxiety Disorder (CRUfAD), based in Australia. In 2013 alone, they report publishing about 25 studies, most of them randomized-controlled trials (RCTs), attempting to establish the efficacy of their programs for the treatment of mood and anxiety disorders like Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD), Panic Disorder, and Social Anxiety Disorder.

Audience: No preference

Price is free

Website Link:
https://thiswayup.org.au/

WorryWatch

For individuals with chronic worry, anticipatory anxiety, and GAD, this app provides simple self-monitoring and documenting of worry within a pre-fixed menu, as well as a graphical tool that charts the worry entries by various factors. It also prompts the user to think about whether he or she believes the actual worry was as bad as what actually happened.

This app was created based on the personal experience of a longtime sufferer of GAD. It is not meant to replace traditional therapy such as CBT but can be used to supplement it. It is not suited for those who have difficulty interpreting graphical representations of information. It would be helpful to have a tutorial to highlight the features of the app and how to use it. It does a terrific job of displaying evidence of the intensity, frequency, and duration of cognitive distortions.

Audience: Teens, parents, adults, men, women, veterans

Price: Under $4.99, no subscriber fee

Website Link: https://worrywatch.com/

Significance:

Moving forward, conducting research in E-Mental Health would be profitable towards the mental health community. What I hope to gain with this research is to examine what works and what doesn't work when looking at technology and mental health. This research is important, since it could shrink the gap in people getting treated for their mental health not only locally but internationally.

Conclusion:

In the future, there will be more e-mental health applications that will be made. With the ones that exist provides an opportunity to examine what is effective and doesn't work.

This can create a guide for future e-mental health applications. These e- mental health applications can reach people beyond geographical barriers, since most people have access to electronic devices, but not everyone has access to mental health services.

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The Role of Disability Cultural Centers in Creating a Supportive and Transformational Experience for Students with Disabilities

As recent debates among the disability community deepen between the usage of identity-first language (disabled persons) versus person-first language (persons with a disability), we believe person-first language is more inclusive and respectful to the entirety of the disability community.*

Introduction

According to the Disability Statistics Annual Report, the percentage of people with disabilities in the U.S. population rose from 11.9% in 2010 to 12.6% in 2013, 2014, and 2015 (Kraus, Lauer, & Houtenville, 2018). The first group of people with disabilities advocated for during the disability rights movement in the 1970s was people with physical disabilities. From the disability rights movement, supporting laws appeared like the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990, and the Individuals with Disabilities Education Act (IDEA) of 1990. These laws were passed to enforce, protect, and advocate for people with disabilities by supplying accessible, academic accommodations, so no student is left behind. Enrollment has increased for students with disabilities in academia from the impact of these progressive laws

In 2013, the National Center for Educational Statistics (NCES) reported that 2,563,000 disabled students enrolled nationwide, accounting for approximately 11% of all undergraduates in the 2011-2012 academic year. As the number of students with disabilities increases, the need has exponentially increased to address the challenges and barriers students with disabilities face i.e., accommodations, accessibility, cultural inclusion, diversity, education, etc. Research has shown graduation rates for disabled students to be as low as 13% compared to 30% among their non-disabled counterparts (Hong, 2015; Wagner, Newman, Cameto, Garza, & Levine, 2005).

Even though these laws have been placed to protect and advance students with disabilities, graduation rates are still incredibly low, even with proper accommodations. There are several factors attributing to low retention rates among the disability community such as difficulty accessing accommodations, the lack of cultural inclusivity, and ableist language and discrimination. Ableism is the discrimination of and social prejudice against people with disabilities based on the belief that typical abilities (people without disabilities) are superior. Ableism is rooted in the assumption people with disabilities are helpless, incapable, and solely defined by their disability. The rise of disability pride among people, groups, and organizations is transforming how people with disabilities are normalized and viewed.

Based on the National Center for Learning Disabilities, many institutions of higher education do not accept paperwork from a student's K-12 Individualized Education Program (IEP) or a 504 Plan because the records are too "old," meaning for students to receive their accommodations, they must be re-evaluated. The process of re-evaluation can be very lengthy and expensive. Overall, this hurts students with disabilities, but also the population of students with disabilities who are not financially stable to afford re-evaluation.

Some disability resource centers will provide students with a stipend or a grant to be re-evaluated, but not all of them. Disability laws need to continue evolving and progressing because the needs of the disability community constantly change and we cannot allow them to fall behind, which is what is currently happening in several higher education institutions. We need to see a step in the right direction for disability law reform, but another part of the disability experience is being unaddressed, which is disability community, culture, and identity. Disability services in higher education handle providing academic accommodations. While this is needed for students with disabilities to be equal academically, they do supply a sense of community for students. There is a lack of cultural inclusion for the disability community in higher education. One way to resolve this gap is to develop and implement disability cultural centers (DCCs) in higher education. As a student at California State Polytechnic University, Pomona, three years ago, I engaged in the Access and Disability Alliance (ADA), which strives to create a more inclusive and accessible university experience for students of all disabilities. It affirms the intersectional experiences of people with disabilities by advocating for disability justice, building disability culture, and facilitating disability community and belonging. A DCC was mentioned very few times throughout the years of my involvement. A DCC would be important for the campus community because it would allow there to be a safe space to cultivate a community-based culture and exploratory environment for students, faculty, and staff members with disabilities.

At the time, the President of ADA, Dr. Catherine Whitaker, who is still a valuable mentor to me as a disability advocate, encouraged me to pursue creating a DCC for the university. I began working on the development of the DCC with Paul An, who is a strong advocate for the disability community. Paul graduated that year, and the following year, I diligently worked with various students, faculty, and staff to establish a DCC. This included the formation of a university-wide committee, distributing a survey to students with disabilities, and working with other DCCS to learn how they established a DCC at their university. There are many things we had to consider including the physical space, funding, and how the space would operate. The university student-run newspaper wrote an article on the work we are doing titled, "Survey seeks CPP community opinion on proposed Disability Cultural Center." Since I started learning about DCCs, I have been passionately involved in the space. During the Spring 2020 semester, I interned with the National Council on Independent Living (NCIL). During my time as an intern, I wrote an opinion piece on DCCs called, "The Importance of Disability Cultural Centers in Higher Education," which was shared by Judy Heumann on Twitter.

Traditionally, higher education institutions have focused on basic legal compliance and accessibility rather than a cultural shift in how disability is viewed on campus (Hong, 2015). From a social model perspective, disability is routinely missing from diversity representation in the academic arena. Higher education is incredibly important because college transition often spurs identity development (Forber-Pratt, et al., 2017). While disability representation and advocacy are one of the most underrepresented groups, the study of disability has extended to Disability Studies curricula programs, clubs, student organizations, committees, special projects, initiatives, and DCCs. Progress is moving along, but it needs to accelerate and quicken to ensure people with disabilities are integrated and considered in all aspects of society. While there are many ways universities can create a more inclusive and diverse environment for students with disabilities, the purpose of this research project is to learn how different DCCs throughout the United States are supporting students with disabilities. How are they creating a supportive and transformational experience for students with disabilities? These are the focal questions I will be exploring in this paper. The emergence of DCCs in higher education will contribute to a better university experience for students with disabilities and shift how higher education works with students with disabilities.

Literature Review

What is a Disability? Before the concept of a DCC is explored, it is important to understand what a disability is. The definition of what a disability is and how it is perceived can severely change how people with disabilities are treated. According to what is commonly known as the Sapir-Whorf hypothesis, the language we use decides the way we understand the world (Sapir, 1949; Whorf, 1956). An example is, when women are described as inferior to men, people begin to believe women are inferior to men. This same notion can be applied to the disability community. As language constructs society and heavily shapes how we see the world, we must begin to use language thoughtfully to support people with disabilities. How we use language and assign meaning has a societal, political, and economic impact. If we continue to label and use language that is hurtful to people with disabilities, we are perpetuating behaviors and attitudes that will arise as subconscious bias and negative attitudes towards the disability community.

Medical Model of Disability. Models have been used to conceptualize what a disability is. Throughout history, even today, people tend to view disability as a form of medical diagnosis which needs to be treated and fixed. This is commonly referred to as the medical model of disability. The medical model of disability defines an illness or disability as the result of a physical condition, which is intrinsic to the individual (it is part of that individual's own body) and which may reduce the individual's quality of life and cause clear disadvantages to the individual. Disability advocates are actively moving away from the medical model because it implies there is something wrong with a person's mind, body, or both because of their disability. This traditional model of disability only sees disability as an obstacle that needs to be cured. For someone to hear their disability is something that needs to be repaired or fixed to live a "normal and healthy" life can result in identity issues and internalized ableism (internal feelings of hatred of their disability and potentially the disability identity as a whole). The meaning of disability goes beyond a medical diagnosis.

Social Model of Disability. Advocates are moving towards adopting the social model of disability, which is a holistic way of viewing disability and how the world should be organized. The social model of disability explains how people with disabilities are "disabled" by the barriers and challenges instilled in them by societal beliefs, behaviors, microaggressions, people, groups, and institutions. While it is up to the individual interpretation of how someone identifies, the social model of disability is important for institutions to adopt because it helps them recognize the barriers that make life harder for people with disabilities. Disability with a social justice approach will examine institutional structures, programs, and policies as these are institutional manifestations of ableism (Evans, Broido, Brown, & Wilke, 2017, p. 2). If we view disability from the social model, we are not advocating to remove or erase the disability experience like the medical model

of disability but remove the barriers that negatively affect people with disabilities. This will allow people with disabilities to live an independent life with more autonomy, choice, and freedom.

Higher Education, Intersectionality, and Microaggressions. Looking at the social model of disability, it is up to institutions of higher education including students, faculty, and staff members to shift the way they describe, view, and construct disability. Disability education is a shared responsibility and needs to drastically change for a paradigm shift to occur. Disability in higher education should be approached as a form of diversity and intersectionality (Kim & Aquino, 2017). Intersectionality is the interconnected nature of social categorizations such as race, class, sexuality, disability, veterans' status, gender, etc. as they apply to a given individual or group, regarded as creating overlapping and interdependent systems of discrimination or disadvantage. "Intersectionality challenges additive analyses of oppression and instead views each system of oppression as a unique component of an overarching, interlocking matrix of domination" (Miller, 2018). Several institutions implement minimal programs and support for the disability community. Higher education should provide the same efforts, supports, and resources for disability as they do other minority groups to help retain disabled students, including challenging ableism and microaggressions. Microaggressions are defined as commonplace comments or actions that negatively target a marginalized group of people. A microaggression can be intentional or accidental. It is a form of discrimination. If university institutions view disability from the social model of disability, accommodations wouldn't be the only thing addressed for the disability community.

The History of DCCs. The concept of a DCC in higher education is new. DCCS appeared from the rise of the civil rights movement in the 1960s and 70s and the signing of the ADA in 1990. The first DCC was founded in 1991 by students at the University of Minnesota and still exists as the student-led Disabled Students Cultural Center (DSCC). Then the DCC at Syracuse University and the D Center at the University of Washington emerged early in this decade. These centers focused on universal design, inclusive culture, and a positive community. The space allowed students with disabilities to interact with one another. In the past few years, we've experienced a relative surge in DCCs on college campuses with strong interest from students, faculty, and staff across the U.S. Currently, the existing DCCs are at UMN-Twin Cities, University of Washington, University of North Carolina-Asheville, Stanford University, University of Illinois-Chicago, University of Arizona, and Miami University of Ohio. Duke University, Brown University, University of California-Berkeley, University of Michigan-Ann Arbor, and the University of Georgetown have DCCs in progress. These centers have followed the formula of other cultural centers for other underrepresented groups.

The Definition of a DCC. With this in mind, what exactly is a DCC and what is it not. First of all, a cultural center serves as a gathering place for communities of various identities and cultural backgrounds. These centers foster a sense of cultural appreciation of history and identity, facilitate dialogue, celebrate, and acknowledge lived experiences, encourage social activism, and develop and strengthen community. From this definition of cultural centers, it can be directly applied to the disability community. According to the University of Syracuse, a DCC coordinates campus-wide social, educational, and cultural activities on

disability issues for students, faculty, staff, and community members with and without disabilities. A DCC encourages deep reflection of identity/agency, community, and purpose. A DCC guides students to practice personal agency and actively connects students to the disability community. Most importantly, DCCs have the power and influence to educate the campus on the history and culture of disability justice and activism. To clarify, a DCC is not a Disability Resource Center (DRC) or Disability Services. The mission of DRCs is aimed at empowering the community with resources, knowledge, and skills necessary to ensure full access and engagement for students with disabilities in all aspects of academic, and college life. While this is crucial for students with disabilities to thrive and be equal in an academic context, it does not address disability culture and community like a DCC would.

Disability Culture. Anthropologically, culture is interpreted as the shared set of values, concepts, and rules of behavior that allow a social group to function and perpetuate itself. It is not just about a particular attribute, characteristic, language, race, or belief, it is understood as a dynamic and evolving socially constructed reality that exists in the minds of social group members. It is best understood as a social movement that champions "a sense of common identity and intersections that unite people with disabilities. It separates them from their non-disabled counterparts." (Barnes & Mercer, 2001, p. 522). While the spectrum of disability is radically diverse i.e., mobility, physical, spinal cord, cognitive, vision, hearing, learning, psychological, and invisible disabilities (a disability you cannot see), the identity of disability is a shared experience that binds the community together. Unfortunately, there are attitudinal barriers that challenge the acceptance of disability culture. The medical model of disability enforces this. The stereotypes of disability stem from the medical model of disability, so people tend to believe disability is not a culture, but a medical impediment. Even some people with disabilities believe this to be true. While it is never anyone's place to disregard someone's experiences because some people truly don't believe disability can be a culture. But based on the definition of culture, disability is a huge cultural group. People with disabilities forged a group identity with a shared experience over a history of abuse, institutionalization, experimentation, oppression, intergenerational trauma (trauma that is passed down from those who directly experience an incident to subsequent generations), ableism, and struggle. Disability culture can bring together a community of a larger group of individuals with disabilities. Disability pride and culture are expressed through the arts, literature, sport, and ways of doing and thinking.

DCCs are an invaluable space for students with disabilities to succeed. They also provide an opportunity for members of the university to learn about the community and how they can understand people with disabilities more. Disability has often been left out of many diversity and inclusion conversations. Universities, now more than ever, need to be initiative-taking in providing support for people with disabilities, including opening up a cultural space to recognize disability as a cultural community. This will move our culture to be more inclusive and move beyond just compliance.

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Disinfection Capabilities of Nanofiber Membrane Functionalized with Antimicrobial Peptide

ABSTRACT

Contamination of drinking water is a major concern across the world with waterborne diseases being a major cause of death, especially in developing countries. Today the primary methods of water purification are energetically demanding and involve chemical additives, like chlorine and ozone, which have been shown to form dangerous byproducts harmful to both human health and the environment. Recent engineering has developed novel filter membranes functionalized with antimicrobial nanoparticles like silver and copper but as the field of nanotechnology advances, scientists continue to speculate on the potential hidden effects of exposure to these as well. Filtration devices constructed using biological material are a relatively new concept with the potential to be safer and more cost-effective alternatives to earlier methods of purification.

The project described in this report is part of the larger aim by Dr. Farhana Abedin of the EMET Department at Cal Poly Pomona to produce a novel filter device using nanofiber functionalized with an affordable, naturally occurring, and non-toxic antibiotic peptide as a safer approach to sanitization. In this project, electrospun polystyrene nanofiber was used to establish an effective binding protocol for the immobilization of peptides onto the fiber to generate a functionalized filter membrane. Once an effective coupling protocol was established, the nanofiber was incubated with Staphylococcus aureus and Escherichia coli to determine whether the functionalized nanofiber exhibits significant activity against bacteria in comparison to unfunctionalized nanofiber. This protocol ubiquitously immobilized peptide across the fiber but did not show any significant inhibition or lysis of bacteria. Future work may incorporate more potent peptides and protein detection techniques to confirm the stable attachment of antimicrobial peptides to the nanofiber.

Major Objectives

The aim of this project was to develop a binding procedure for the coupling of antimicrobial peptide (AMP) and amine terminated cellulose acetate polystyrene nanofiber as well as to demonstrate that the functionalized nanofiber is be able to inhibit or lyse bacteria. This goal was designed with the major intent being to ultimately produce a novel filter device using nanofiber functionalized with an affordable, naturally occurring, and non-toxic antibiotic peptide as a safer approach to sanitization. The project seeks to establish an effective protocol for immobilizing peptide onto nanofiber threads, to determine whether the immobilized AMP would exhibit bactericidal activity, to determine if binding would disrupt the antimicrobial activity of the peptide or the filtration ability of the nanofiber membrane, and to establish the best practical approach for testing the fiber efficacy.

Literature Review

Water availability is a permeating and universal topic of debate as of late. One of the most blatant symptoms of climate change is the disruption of the global water cycle. On a planet where less than 1% of water is available for human use, warming temperatures can bring volatile seasons and exaggerated rain patterns that threaten to reduce this number further. Contamination of drinking water is already a serious concern across the world unaccompanied, with waterborne diseases being a major cause of death, especially in children. And while water treatment is generally associated with making people safer and healthier through the removal of harmful particles and microbes from our water sources, current approaches to water purification, while it keeps our water fresh and clean, might be creating hazards in our environment. As of right now, primary methods of water purification involve chemical additives which have been shown to form dangerous byproducts harmful to both human health and the environment. Chlorination has been held as one of the greatest achievements in public health, however, there are concerns with the amount of chlorine, chloramines, and other disinfection by-products present in drinking water. Chloramine is known to react with pipes in a way that can release copper and lead into the water supply. Water treatment plants are also significant contributors to greenhouse gas emissions and makeup 3% of the energy consumption in the United States.2 These facilities are large, taking up a significant amount of land, and consist of multi-step processes that combine separate filtration steps and disinfection steps. Nanotechnology has proposed new purification methods in the form of membranes functionalized with antimicrobial nanoparticles like silver but these exhibit leaving that can have unforeseen consequences to health and the environment as well.3 Though wastewater reclamation and treatment plants have greatly improved over the years in water safety, sustainability, and sludge disposal, there is a need for improvement. By functionalizing nanofiber with antimicrobial peptide (AMP), a filter membrane device capable of both filtering particles and inhibiting pathogens in one efficient step could be realized.

The incorporation of AMPs Magainin II and KR-12 in the design of this project engaged the relatively new field of AMP research. Following the golden era of antibiotic discovery, overuse of small molecule antibiotics has led to major disease-causing bacteria that are no longer susceptible to current treatments. AMPs are complex, broadly active proteins specialized through ages of evolution in every species' arms-race against pathogens. AMP research has been on the rise as medical professionals seek alternatives to modern antibiotics, particularly small molecules drugs, that are no longer effective against some of the most medically relevant infections. Beyond simply desperation for novel treatments against resistant infections, some of the attractive features of AMPs include broad-spectrum microbicidal activity, low resistance rates, and relative safety. AMPs have exhibited antibacterial, antifungal, and antiviral activity and it is speculated that the complexity of these peptides and the variety in their mechanisms also drive the reduced incidence of resistance when compared to conventional small-molecule antibiotics. AMPs have even been shown to exhibit immunomodulatory activity, which makes them stand out further as candidates for pharmaceuticals. One example is a peptide synthesized from one type of naturally occurring defense protein called cathelicidins. Cathelicidins are stored in neutrophil granules or expressed during inflammatory episodes, and in humans, the single cathelicidin known is called hCAP18. In Kosikowska and Lesner (2015), researchers

synthesized an AMP subsequently named P10 from hCAP18. The researchers were able to identify that not only did the AMP P10 exhibit microbicidal activity but was also able to neutralize pro-inflammatory bacterial endotoxins and stimulate macrophages. This project aimed to utilize the multifunctionality of AMPs to develop a device rather than a pharmaceutical, which emphasizes the potential of AMPs and the need for more projects integrating AMP research to contribute to a better understanding of the mechanisms, capabilities, and prospective applications of them. The most impactful deciding factor in choosing to work with AMPs was the safety of AMPs, as the primary objective was to generate a greener and more harmless alternative to nanoparticles and noxious chemicals. Though there is a demand for additional toxicology studies on AMPs, they are considered safer than small-molecule antibiotics because they degrade into amino acids, which occur naturally in the body and environment. Because AMPs are made of amino acid residues, they have a short half-life and do not accumulate easily in the body. They are also less immunogenic than some of the latest technologies used to fight infection such as recombinant proteins or antibodies. The incorporation of the relatively new fields of both nanofiber technology and AMP research makes this prospective filtration device innovative and pushes further the frontier of scientific knowledge.

Methodology

The first step was to establish an effective binding protocol for the immobilization of peptides onto the polystyrene nanofiber. A two-step protein coupling protocol was tested which involved reacting the nanofiber's amino group with the peptide's carboxylic group (Figure 1).
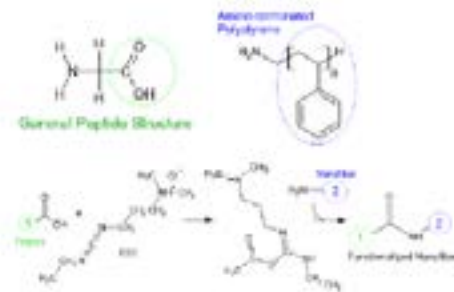

Figure 1. Proposed binding mechanism for peptide

This procedure utilized a carbomiide conjugation technique to functionalize the nanofiber. First, solid peptide was dissolved in acidic activation buffer free of extraneous carboxyl or amine groups which could interfere with the conjugation at a concentration of 1 mg/mL (Scientific BupH MES Buffered Saline). This peptide solution was then treated with 1-ethyl-3-(-3-dimethylaminopropyl) carbodiimide hydrochloride (EDC)(2mM) to activate the peptide's carboxyl group for amide bond formation. Then, Sulfo-NHS (5mM) was added to this solution which becomes coupled to the carboxyl group by EDC to form a stable intermediate. This was left to react for 25 minutes at room temperature before 2-mercaptoethanol was added to terminate the reaction (20mM). At this point, nanofiber samples were introduced to each of the solutions and allowed to react for 1.5 hours with rotation at room temperature. The last step was the addition of HCl-hydroxylamine to quench this final reaction (10mM). The functionalized fiber was then rinsed three times with phosphate-buffered saline (PBS) to remove any unreacted peptide.

There were two methods used to test the bactericidal activity. In the first, Magainin II was used to functionalize the nanofiber. Bacteria solution (Escherichia coli) was passed through an apparatus constructed using the functionalized fiber to which the filtrate was collected and plated for growth. The functionalized fiber was also directly incubated with the bacteria solution rather than having it passed through to measure bacteria survival and growth via plating. Then, diluted liquid cultures of both Escherichia coli and Staphylococcus aureus were treated directly with Magainin II (1 mg/mL) and cell growth was measured using spectrophotometry.

In a second trial, KR-12 peptide was tested against Escherichia coli by treating liquid bacterial dilutions with KR-12 solution (1 mg/mL). Once antibacterial activity could be determined, nanofiber samples were conjugated with KR-12 and incubated in bacterial solution for thirty minutes. This bacterial solution was observed for growth over 8 hours using spectrophotometry.

Results

When FITC-FLAG peptide was used in the conjugation, it was confirmed through fluorescent microscopy that peptide was ubiquitously immobilized along the nanofiber threads. Thus, KR-12 and Magainin II can be assumed to have also coupled effectively with the nanofiber.

It was found not only that Magainin II functionalized nanofiber did not exhibit a significant level of lysis upon incubation with bacterial solution, but that Magainin II solution even when used directly own did not exhibit significant bactericidal activity against Escherichia coli nor Staphylococcus aureus when compared to the control (Figure 2).

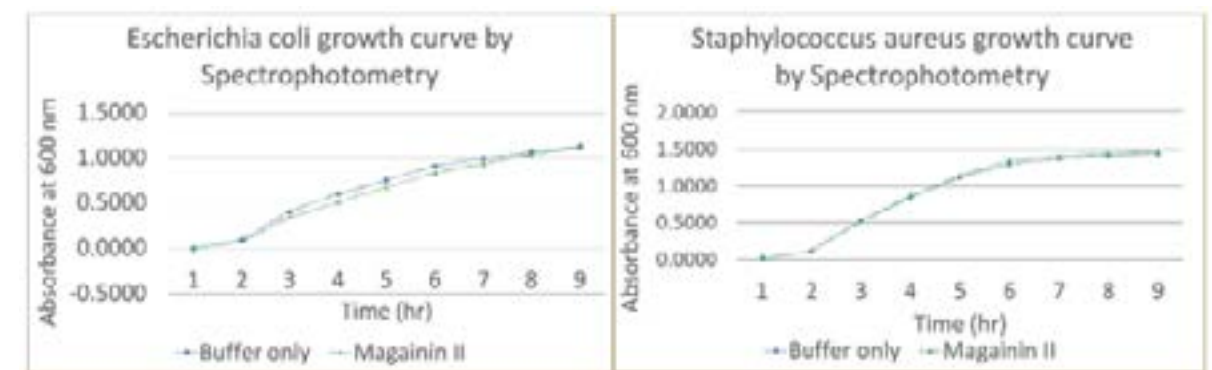

Figure 2. Bacteria growth curves after treatment with Magainin II

When Escherichia coli was directly treated with KR-12 solution (1 mg/mL), it was shown to immediately and effectively inhibit growth (Figure 3) when compared to the buffer control.
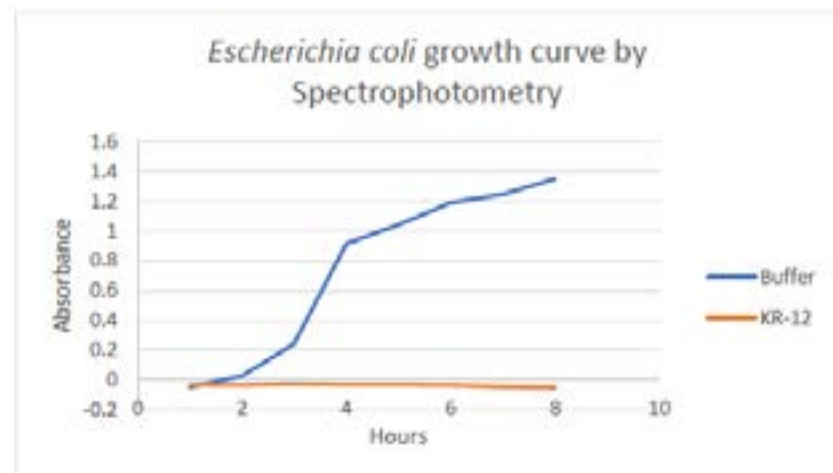

Figure 3. *E. coli* growth curve after treatment with KR-12

KR-12 did not maintain this antibacterial activity after conjugation with the nanofiber. Of four treatment groups, KR-12 only, nanofiber only, KR-12-conjugated nanofiber, and untreated bacteria control, after incubation with each treatment there was only significant lysis observed in the KR-12 only positive control after 8 hours (Figure 4).
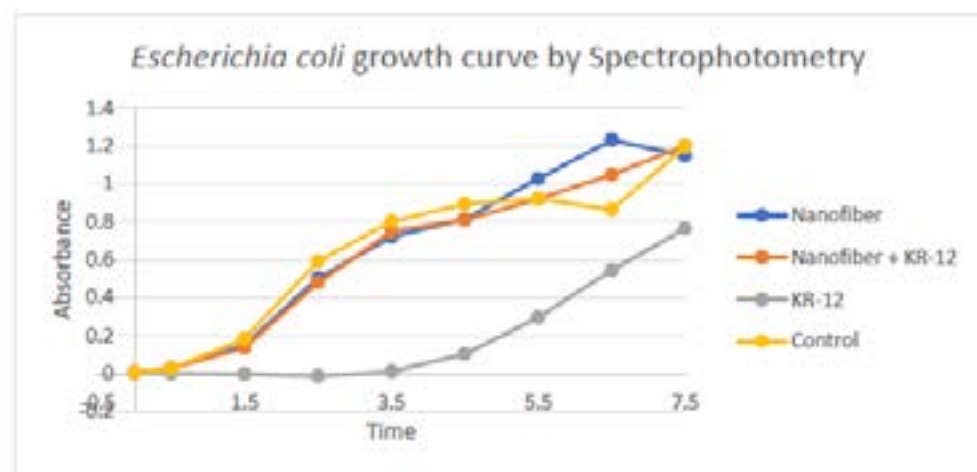

Figure 4. *Escherichia coli* growth curve for KR-12 functionalized nanofiber

Discussion

The binding approach was shown to be successful. The nanofiber was coupled with FITC-FLAG peptide as a fluorescent control to visualize this approach's ability to effectively bind peptides to the polystyrene nanofiber. This study confirmed that the carbomiide conjugation technique using EDC was very effective at immobilizing the peptide throughout the nanofiber threads.

While nanofiber functionalized with Magainin II was not able to lyse or inhibit bacteria, it was able to be determined that this was not due to the coupling itself but rather that Magainin II itself was ineffective against these particular strains of Staphylococcus aureus and Escherichia coli. Unlike Magainin II, KR-12 peptide was highly effective at inhibiting growth of Escherichia coli. Unfortunately, once conjugated to the nanofiber this activity is lost as the inhibition can no longer be observed. There are two primary speculations as to why this might be, the first being that the peptide is unable to be effectively immobilized onto the nanofiber and is simply being washed off, or the second being that the peptide is being immobilized ubiquitously but in a way such that the peptide's confirmation is being compromised and critical binding sites for bactericidal function are left unavailable. Additional research is needed to further investigate and potentially alleviate these complications.

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Luis G*   **Spanish Heritage Language Learners: Reading difficulties and spelling errors**

ABSTRACT

The acquisition and development of spelling is a complex process that involves learning the language's orthographic code, as well as developing an awareness of its phonological and morphological structure (Defior et al., 2015) and a mental visual lexicon of written words (Ehri, 1980). Spelling proficiency is a key component of literacy, connected to reading fluency, reading comprehension, and vocabulary knowledge (Ocal & Ehri, 2017). In recent years, we have witnessed an increase in studies on Spanish Heritage Language Learners' (SHLL) spelling proficiency of SHLLs, mostly error analyses that use either naturalistic data (Beaudrie 2012, Belpolitti & Bermejo) or (quasi-)experimental data (Beaudrie 2017, Llombart-Huesca & Zyzik (2019) to find out what the most frequent errors in SHLLs' writings are. Llombart-Huesca's (2019) study suggests that vowel misspells involving the letters e and i are due to difficulties in phonological awareness, which are greater in phonological complex contexts, such as diphthongs. Although no study has been conducted yet connecting spelling and reading fluency in SHLLs, Llombart-Huesca (2019) makes the observation that although SHLLs can read fluently, once they encounter certain words, (e.g., long words, unknown words, and words with diphthongs, they tend to get stuck or desist from pronouncing them. Our study tests this observation to help determine whether spelling errors in words with diphthongs involving e and i are due to students' difficulties in reading them. In this study, participants were asked to read a list of 40 words, which appeared on screen in isolation. Items were divided in these 4 conditions (ten words in each):

	Diphthong (ie)	Monophthong (Cons+Vocal)
Real words	e.g., desciende	e.g..espejo
Pseudowords	e.g., cafiento	e.g. pamena

Words with diphthongs were hypothesized to cause more reading difficulties than words with monophthongs, mirroring Llombart-Huesca's (2019) findings in spelling. Pseudo-words were also hypothesized to be more difficult to read than real words, since unknown words cannot be recognized and need to be decoded, which requires phonological awareness. Preliminary results show a gradation in reading accuracy of the target letter "e":

realmonophthong> pseudoword-monophthong > pseudoword-diphthong > pseudoword monophthong, thus, confirming our hypothesis. We discuss these results in relation to previous research in phonological awareness and literacy in SHLLs. These findings will benefit researchers in the SHLL education field. Underdeveloped phonological awareness hinders spelling and reading, but it might be masked by lexical knowledge and only surface when attempting to reach more advanced degrees of reading and spelling fluency and accuracy.

Major objective(s):

Question 1: Do SHLLs make more errors when reading words that contain diphthongs than words that contain monophthongs? Question 2: Do SHLLs make more errors when reading pseudowords than when reading real words? Question 3: Do results of the reading task correlate with the dominance scores provided by the BLT task?

Background research with analysis and summary of literature review: It has been widely recognized that one of the linguistic aspects that give Spanish Heritage Language Learners (SHLL) more difficulty is orthography (see, for example, Carreira 2012 and Beaudrie 2012). A heritage language learner is defined as "a language student who is raised in a home where a non-English language is spoken, who speaks or at least understands the language, and who is to some degree bilingual in that language and in English" (Valdés, 2001, p. 38). Although there has been an abundance of research conducted on SHLLs' language development, it has focused on other aspects of their education, such as grammar development (for example, Montrul and Slabakova 2003), the development of a standard variety (Valdés 2005), and some sociolinguistic and affective elements of their education (for example, Martínez 2003). However, basic literacy skills are under-researched: spelling development has only started being researched in the last decade, and the studies in this area are scarce and still incipient, and reading fluency and accuracy has not entered the radar of SHLL's education yet. Some of these studies on spelling have focused on knowing what the most frequent spelling errors are (Beaudrie 2012, Contreras-Wise 2020), and they have focused on errors that are due to writing one letter instead of another, as a result of students not knowing the specific spelling rule. **The current study focuses on different types of spelling errors; those due to poor Phonological Awareness (PA).**

Methods (Experimental procedure/design):

Participants: The participants of his study will be SHLLs enrolled in several SPN courses, specifically, some lower-division courses, but mainly upper-division. A SHLL is defined as "a language student who is raised in a home where a non-English language is spoken, who speaks or at least understands the language, and who is to some degree bilingual in that language and in English" (Valdés, 2001, p. 38). I expect that the approximate number of students that will take part in this study will be 30. This is a convenience sample.--Quantitative: In the reading task items are in a 2x2: Type of syllable (diphthong vs. monophthong) and type of word (real word vs. pseudo words). Ten items each, for a total of 40 items. There is only an experimental group and the dependent variables (BLP score and reading task scores) will be measured only once. The analysis that will be conducted is a repeated-measures analysis of variance (ANOVA) with two

within- subjects variables (type of syllable and type of word). We will also look at the correlation between the scores in the BLP test and the reading task. Previous studies have shown a moderate to strong correlation between language proficiency measures and the score in the BLP test. The BLP (Bilingual Language Profile) is an instrument for assessing language dominance through self-reports. The BLP is intended to produce a continuous dominance score and a general bilingual profile taking into account a variety of linguistic variables. The BLP is an open and free assessment tool for researchers, educators, and anyone with an interest in assessing language dominance. We will not report on the subcomponents of the test. We will only use the final score that the test provides-- Qualitative: We will also look at the specific errors participants produce, to offer a qualitative description that adds to the overall understanding of the reading difficulties of Spanish heritage language learners.

Please describe progress made this period towards your project's stated goals and objectives: (This section is a summary of what you have found out in your experiment so far. Your data/result and discussion should be included here): The progress that has been made includes the following: receiving IRB approval, beginning to schedule interviews with students from the Spanish classes, Spanish majors, philosophy classes, and friends from college, collecting the interview data/ BLP survey and organizing it. Furthermore, we found the following results: "E" in monophthongs was read significantly more accurately than "e" in diphthongs, "E" was read with the same accuracy in real words and pseudowords, Participants were more accurate when reading diphthongs in real words than they were when reading diphthongs in pseudowords, Reduction was the most common result in both cases, there was no inversion in real words, and there was no correlation with the BLP.

If your project has not advanced the way you had planned, identify the impediments to progress you encountered during this period? What steps have you taken to move your project forward? N/A

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Lujan
Maria   **Mutual Aid Networks in Asian American Communities**

Abstract

This project explores the role of mutual aid networks/groups in Asian-American communities and what role they had during the pandemic. Mutual aid networks collaborate to satisfy the needs of their members, in this case, the Asian American community. Mutual Aid networks are fundamental in spreading awareness about the existence of these groups because the system failed to address their demands and meet their needs. This research examines mutual aid efforts among the Asian American community during the pandemic through a literature review and media analysis. An analysis of newspaper articles from 2020 to 2021were conducted to analyze how Asian American communities engaged in mutual aid work and how it was presented to the public.

Introduction

This paper will concentrate on mutual aid networks in Asian American communities, specifically during the COVID-19 pandemic. The research question that guided this project is: What role did mutual aid networks have in Asian American communities during the pandemic? It is projected that mutual aid networks would expand significantly during the pandemic and that Asian Americans will prioritize supporting their community. This paper will analyze the role of mutual aid networks during the epidemic using data from newspapers that compile narratives about Asian American communities.

Literature Review

Mutual Aid Networks

Mutual aid happens when members of a minority, primarily the Asian American community, join to meet each other's needs, with the common understanding that the institutions in which they live are failing to meet their needs. Mutual aid is a form of political participation in which people take responsibility for caring for one another and changing political conditions, not just through symbolic acts or putting pressure on their representatives in government but by actually building new social relations that are more survivable (Brigade, 2019). The framework of mutual aid is significant in social movements resisting capitalist and colonial domination, in which wealth and resources are extracted and concentrated and most people can survive only by participating in various extractive relationships. Providing for one another through coordinated collective care is radical and generative (Spade, 2020). It is important to underline that mutual aid is not charity, but it is the formation and maintenance of new social connections in which individuals give what they can and get what they need outside of unjust power systems.

The framework of mutual aid is significant in social movements resisting inequalities. Providing for one another through coordinated collective care is radical and generative. Effective social movements always include elements of mutual aid (Spade, 2020). The most famous example on the left in the United States is the Black Panther Party's survival programs, including the free breakfast program, the free ambulance program, free medical clinics, a program offering rides to elderly people doing errands, and a school aimed at providing a liberating and rigorous curriculum to children (Collier, 2015).

The existence of community-based organizations in Asian American communities is crucial to meet their needs, especially during the pandemic, when minorities were left behind. However, the underlying principle of early voluntary associations is that communities should help their members. These organizations were typically started by volunteer laypeople and based on the special interests, trades, and needs of their members. Racial, ethnic, and religious minorities, in particular, relied on these organizations for financial, spiritual, and emotional support (Gamm & Putnam, 1999). As a minority in the United States, the Asian American community established community-based organizations from the mid to the late 1800s to have a sense of belonging to something in common with other people who share their cultural perspectives.

Ethnic community-based organizations have since developed to provide human services, but they still keep the same values and spirit as their predecessors. Usually, in the communities they serve, ethnic community-based organizations are often familiar with the obstacles and needs of service users and typically sponsor a variety of events and activities to promote community building and social support (Holley, 2003). As a result, ethnic CBOs can provide services that respond to the needs of minority populations in a supportive community setting, especially for new immigrants from Asia (Chow, 1999). As a result, ethnic community-based organizations can provide services that are sensitive to the needs of minority communities in a supportive community context, particularly for the Asian American community. However, scholars argue organizations can help with assimilation.

While collaboration is one form of how these organizations provide services, sometimes community organizations independently provide it. For example, between March and June 2020, residents in north London faced the Covid-19 pandemic by creating neighborhood Mutual Aid groups on WhatsApp and Facebook. These groups not only addressed basic survival needs such as bringing groceries and medicines to infected people, the elderly, and other vulnerable populations in quarantine; they also offered opportunities for social interactions between strangers living in the same neighborhood during the lockdown. Their success was linked to their rapid mobilization, adaptability, and local knowledge. Their bottom-up organization, based on the principle 'Solidarity not Charity', showed a singular way to express dissent with policy response to the pandemic and brought them closer to the horizontal social movements of the 2010s (Chevee, 2021).

During the Covid-19 pandemic, which began in early 2020, the support provided by mutual aid groups has included shopping, collecting prescriptions, providing meals, dog-walking, informational and emotional support, and involvement in running food banks (Solnit, 2020). Their flexibility and local connections meant they were better suited to play this role than centralized or official bodies (Tiratelli & Kaye, 2020). As of May 2021,

there were at least 4317 mutual aid groups operating in the United Kingdom (Covid-19 Mutual Aid UK, 2021). However, the existing power dynamic between helper and helped was reinforced along racial lines, a dynamic which resonates particularly given the wider context of the UK Covid-19 mutual aid movement; research shows that membership in Covid-19 mutual aid groups was overwhelmingly white and middle-class (O'Dwyer, 2020), while the virus itself disproportionately affected on lower-income and minority ethnic groups (Public Health England, 2020).

Disease threat often gives rise to discrimination and scapegoating of "others," for example, foreigners, immigrants, and marginalized groups. In the pandemic brought on by COVID-19, it is not just Chinese immigrants, but any Asian American perceived as having connections to China (e.g., some Southeast Asians and other East Asians) because of false stereotypes that Asians are "look-alike" and anti-Asian/Chinese sentiment (e.g., the "yellow peril" stereotype as discussed later), have become potential targets (Tessler, Choi, & Kao, 2020). While establishing relationships with other marginalized racial groups and the Asian American community as large may not be limited to a few Chinese and Vietnamese Americans, it is unlikely to limit solidarity among most members of these communities. To strengthen emotions of solidarity among Asian ethnics and other racial minority populations, it is critical to identify strategies to foster a sense of connected fate among Asians, Blacks, and Latinx, which improves both intra and inter-racial solidarity (Nicholson, Carter, & Restar, 2020; Sanchez & Masuoka, 2010).

In particular, members of minority ethnic groups may feel marginalized, creating barriers to engagement with healthcare or other services (Public Health England, 2020). In the present case, that the interaction took place in what appeared to be a racist area stressed both the power dynamic between "helper" and "helped," and the participant's self-perception as being from a potentially hostile outgroup in the eyes of the recipient, creating an uncomfortable feeling of intrusion (Mao, et, 2021). Asian American communities continue to engage in mutual aid work through the pandemic, given this long history within the community.

Method

Given their long history in the community, Asian American communities have taken part in mutual aid activities more extensively during this epidemic. To support this claim, I searched the website "ProQuest" in the newspaper section, using the terms "Mutual aid", and "Asian Americans", language: English, and publication date: March 1, 2020 - December 1, 2021. The number of articles found by this search was 276, of which I could analyze 50, only 15 of which applied to mutual aid networks in Asian American communities during the pandemic.

Findings

In these articles, the Asian American community is described as a hardworking group that came together more after being discriminated against during the pandemic, and their sense of mutual aid was strengthened. "During times of crisis, it's easy for us to forget that our AAPI communities are based upon a long history of grassroots action, especially via

varied artistic forms of expression." says the program manager for Pao Arts Center. Indeed, Chinatowns and other Asian community enclaves have always been sites of creativity, aesthetic innovation, and imaginative production that are not well known or often highlighted. (Corrie, 2021). Despite the range, complexity, and sheer volume of Asian American art production, Chinatowns, in particular, remain stigmatized in the public consciousness as places of urban degradation, mysterious foreignness, and even sickness. (Corrie, 2021). Historically, Chinatown and other Asian communities have always countered such representations and beliefs with creativity.

Asian American communities have also been reshaped by the pandemic. Meanwhile, an online course about identity and history sparked a connection between a group of Asian American women across the country. It soon led to a group chat and a monthly Zoom support group. "I feel so bonded to them, even though their experiences might not be the same as mine," Amy Ding says of her new virtual cohort. "As Asian women, there was deep healing and a deep yearning for more of this type of community." At a time in which staying 6 ft. apart has often hampered intimacy (Lang & Monn, 2021). Following the murder of George Floyd, Ding felt compelled to learn more about her Asian American identity to be a better BIPOC ally. Ding and the six other Asian American women—ranging in age from their mid-20s to their late 30s—wanted to continue to meet regularly after the course ended. Located across the U.S. in states from New York (where Ding lives) to Missouri to Texas, they started a WhatsApp group chat and have met virtually on Zoom every month since January. In these video calls, the group discusses topics ranging from books and podcasts that celebrate Asian American voices to navigating relationships, both personal and professional, as Asian American women. The conversations are lighthearted, and in others, the women share their stories about microaggressions and racism. "There's been a lot of experiences of being gaslit," Ding tells her story as an Asian woman in the United States. "When I think of how I've been supported by this group, a lot of it is feeling reaffirmed that there are other people who know what I'm talking about or who understand the hesitations of having [thoughts] like, 'Oh, was that racist?'" (Lang & Monn, 2021). During uncertain times, communities of color have provided a different perspective and created connections that will endure.

Throughout the pandemic, one of the many challenges that Asian American communities experienced was racism. A year after the coronavirus started spreading across the globe, Asian American activists ignited a movement against racism. Propelled by former President Trump's vitriolic comments about the "China virus," there has been an uptick in hate crimes. Members of the Asian American and Pacific Islander community were already rallying and ringing alarm bells before a white gunman allegedly shot and killed eight people in Atlanta spas, six of them Asian women, on March 16. The massacre has opened the public's eyes, and Asian American activists are hoping to harness the momentum and turn it into sustained action (Reyes-Velarde, 2021). For example, Ana Iwataki, 32, founded J-Town Action & Solidarity, which collaborates with "We the Unhoused" to give resources such as clothing, food, and hygiene products to homeless people in Little Tokyo. Following the Atlanta assaults, J-Town has increased its attempts to engage with Asian Americans in the Los Angeles region. Iwataki is mentored by a powerful teacher, her aunt Miya Iwataki, who began her activism in the 1960s under the auspices of the Brown Berets, a seminal Chicano rights organization. In an interview with the Times, Miya explains how for decades, most

people didn't know that there was an Asian revolutionary movement in the '60s and '70s and that our programs were inspired by groups. According to Miya, "The Black Panthers" were the ones that established free breakfast programs, free housing, clothes, and health clinics, and it was these programs that inspired the Asian American movement (Reyes-Velarde, 2021).

As coronavirus-fueled anti-Asian hate crimes surged across the country, a virtual workshop sought to address a herculean task: how do we define Asian American and Pacific Islander (API), an umbrella term for over 50 ethnicities, and how can the API community come together to combat anti-Asian racism? (Ross, 2021). Every two weeks, The Non-Standard Project hosts a virtual affinity space for youth of color to discuss social issues without the eyes of authority. Topics that have been discussed include racial sexualization, Yellow Fever, patterns of white supremacy, mental health, Asian American invisibility, and the Model Minority Myth. According to their website, which contains a resource toolkit, the two core values of the organization are community care and accessibility (Ross, 2021). "One thing many grassroots organizations lack is empathy beyond attachment to group identity," Kim said. "Many Asians that are heavily involved in Asian American organizations do not stand in solidarity with other communities. We should not see ourselves as just boxes." The goal of these workshops, such as the one mentioned above, was to bring Asian Americans and other communities of color together so that they may combat racism and oppression more effectively.

During the pandemic, mutual aid networks not only brought Asian American groups together but also created a sense of belonging and cultural appreciation among this community. "For so long, people knew nothing about Asian Americans. Showing who we are and being proud of who we are, it's really important during this time." Jennifer "Nuky" Phqm, 37, helps run the Celebrate Argyle campaign and books, musicians, and artists, at pop-up events for Haibayo, whose cross-cultural creative collaborations aim to energize Asian culture in the Argyle district. Phqm is a Chicago-born Vietnamese American who co-owns her family's company. She expresses her desire for more people to learn about and respect her people. Jennifer describes how Asians are stereotyped as being all the same. However, Asian-Americans as a group are extremely varied. She describes how, as an Asian, she was taught to keep her head down and not make any disturbance. Not to cause any quote-unquote trouble. For a long time, no one knew anything about Asian Americans. She emphasizes the importance of being proud of who she is during this time, and she encourages others to do the same. Phqm also encourages individuals to give to groups working for justice, particularly AAPI businesses. Over six companies shuttered on Argyle between 2020 and 2021. It's nine—some owing to retirement or a lack of succession, and the majority because of COVID (Montoro, 2021).

Ellen Duang, another Argyle member, expressed several of her worries regarding Asian hatred. She describes how a few weeks ago, a Vietnamese man was walking around at night and was assaulted. Ellen claims that there has been a lot of racism in the words and videos she has seen throughout the world. Ellen is concerned about how Asians are being associated with the virus. She then explains why they made the Stop AAPI Hate video with other members of the Asian American community. "We felt it would be a nice idea to showcase our distinct culture with this outdoor event," Ellen says. We want to create

a venue where Asian American literature is available, and we want to include the community by allowing them to sell their wares outdoors. We would want to see cultural performances. If it makes people feel better, we encourage them to wear traditional garb. I'd be dressed in an "Áo dài", which is a traditional Vietnamese garment. We want to establish a safe environment where we can be proud of who we are. Instead of putting our heads down and being afraid, we're choosing love over hatred right now." (Montoro, 2021).

Conclusion

The present findings show that mutual aid networks in Asian Americans have expanded and strengthened during the pandemic. Asian Americans have grown closer together as a community to protect its members from bigotry and racism since COVID first started. According to the literature review, mutual aid networks are not as prevalent in the Asian American community as they are in the findings section. While mutual aid networks positively affected Asian American communities, it is also important to acknowledge the prejudice and other challenges that these communities experienced. As part of this study, I will continue to examine newspapers to support my research, and will soon undertake in-person interviews with Asian Americans to get additional data for this project. Future studies can expand on the significance of mutual aid networks in other minorities. It would also be interesting to study mutual aid networks in Asian American communities post-COVID considering the growth that has been seen during the pandemic. Mutual aid networks may expand in response to future concerns about supporting Asian American communities.

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Luna Nicole*

Dr Brain Ramirez

Elastic Mechanical Metamaterials for Energy Absorption

Abstract

Foams are commonly utilized to absorb energy in applications with impacts, but they have limited design parameters. Recent advances in 3D printing have enabled the manufacturing of spatially tailored lattice structures with unique properties, often referred to as mechanical metamaterials. This project explores the energy absorption properties of two distinct lattice structures, one having stretching dominant behavior, while the other exhibits bending dominant behavior. The lattice structures were modeled using Solidworks and scaled to the same size and volume fraction. The stress-strain behavior of these lattices were then computationally obtained under a strain rate of 1s-1 using two methods: computationally with a finite element analysis software called ANSYS and experimentally with 3D printed unit cells. From these results, the energy abortion characteristics of the stretching and bending dominant lattice structures were determined.

Background

Foam materials are often utilized for the energy absorption in applications for sports equipment, automobiles, and electronic vibration isolation. Because foams can undergo large deformations at low stresses, they are excellent at reducing the stresses. Foams are stochastic structures manufactured by creating bubbles in the bulk materials and then curing, creating a generally isotropic and homogenous material [1]. This process cannot create foams with properties that vary throughout the material. However, advances in lithography and 3D printing with elastic materials have enabled the manufacturing of metamaterial lattices with non-stochastic cells and spatial variations allowing for tunable energy absorption properties [2, 3, 5].
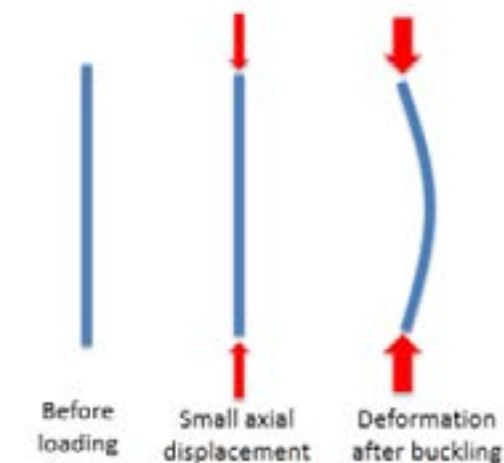

Before loading   Small axial displacement   Deformation after buckling

Figure 1 - Buckling of a slender rod

There are two classes of structures for metamaterial cells, bending dominated and buckling or stretching dominated [3]. A buckling dominated material is characterized by a sudden large deformation or "buckling" at a critical load [2]. This is demonstrated simply with a slender rod under axial, compressive loading in Figure 1. When a small load is applied, a small axial deformation occurs. When the critical load has been exceeded and the rod undergoes large, non-axial deformation. This response to loading can be captured in the stress versus strain plot as shown in Figure 2. The material is very stiff at low loads, indicated by the initial steep section of the plot, the slope of which is called the modulus of elasticity. However, after the critical load has been reached there is a softening indicated by the negative slope. Eventually, the plot plateaus as the material continues to deform at a constant stress until densification. Buckling gives stress versus strain curves a distinctive peak at the buckling load. This behavior is apparent in stretching dominated metamaterials. Bending dominated materials do not buckle and therefore do not have a buckling peak. Instead, they transition smoothly from a steep positive slope to the plateau region. Because of this different compressive loading behavior, unit cell selection is critical for designing metamaterials for energy absorption.
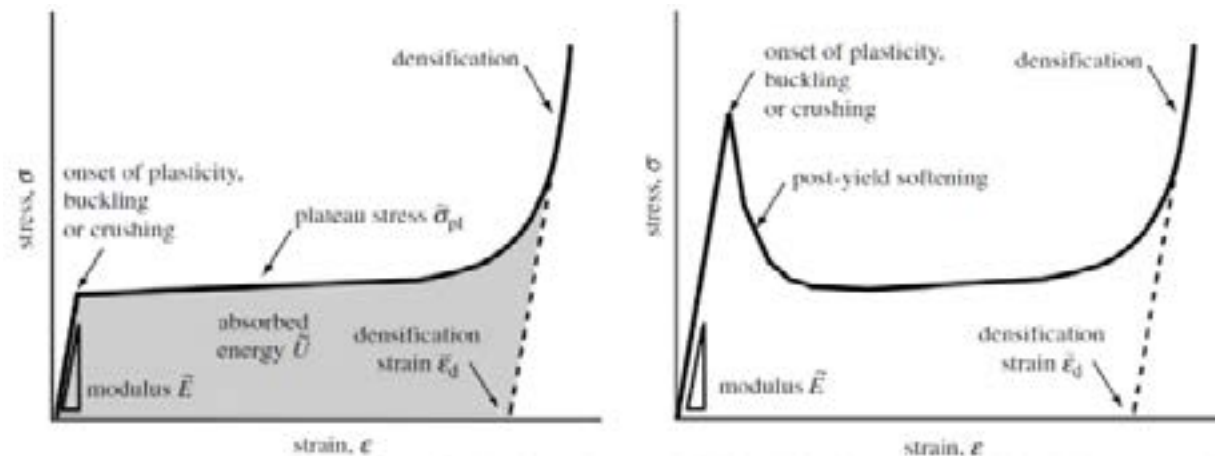

Figure 2 - Stress versus strain curves for bending dominated (left) and buckling dominated (right) structures [7]

The characterization of energy absorption is typically determined from the stress versus strain curve of the material. Strain is a measure of the deformation of the material and the stress is related to the force transmitted through the material. The area under the curve is the energy absorbed during the impact. In energy absorption applications, the objective is typically to minimize the stress during an impact. In Figure 3, three different materials are subjected to an impact with the same energy. A metamaterial lattice that is too stiff will have high stress because it does not easily deform, and a lattice that is too soft will bottom out. The ideal material will have a stiffness, between these two extremes. It is essential to optimize the metamaterial for the expected impact.
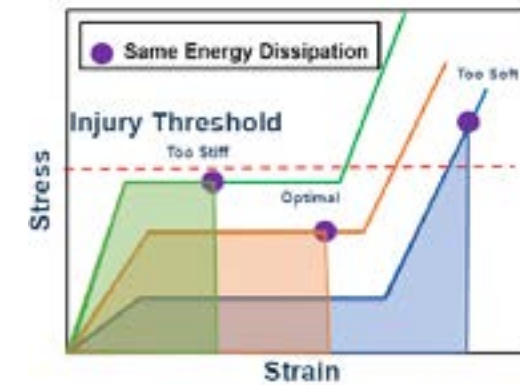
Figure 3 - Stress-strain impact responses for 3 different materials.

Objective

The objective of this project was to simulate impacts with finite element modeling (FEM) of viscoelastic metamaterials and characterize their energy absorption properties. The two metamaterials utilized were an octet unit cell, which is stretching dominated, and a kelvin unit cell, which is bending dominated. The simulation provided data for stress versus strain curves of each cell. The simulation was then verified by 3D printing the unit cells and testing them in lab. With these curves that describe the deformation and energy absorption characteristics, the materials can be applied to specific applications depending on the velocity and energy of the impacts.

Methods

This section contains the steps taken throughout the research project and includes the research tools and methods.

1. Selected unit cells. The unit cells explored in this research include one buckling and one bending dominated cell type. The kelvin and octet cells were selected based on a literature review.

2. Modeled unit cells. The selected unit cells were modeled in Solidworks with equal size and volume fraction. A plate to compress the unit cells was also modeled.

3. Analyzed each cell in ANSYS quasi-statically. For the octet, the geometry from Solidworks and materials properties for a viscoelastic 3D printing material were entered into the Static Structural Pre-Buckling module. The buckling modes were found in the Eigenvalue Buckling module. The first buckling mode was selected to continue the analysis in the Static Structural Post-Buckling module which contained the final loading and data. The ANSYS modules are shown in Figure 4. The bending dominant kelvin was simulated without the buckling analysis. The stress response of the unit cells was captured by the reaction force and the displacement data. This data was converted into a stress versus strain curve for each cell.

Figure 4 - ANSYS modules for static buckling analysis.

4. Analyzed each cell quasi-statically in lab. The unit cells were 3D printed and compressed quasi-statically on an Instron device in lab. The deformation shapes were confirmed, and the stress strain plots were compared with the results obtained from ANSYS.

Results

First the octet geometry was created in Solidworks with thicknesses specified for a volume fraction of 0.1. Two plates were also created, one for the base to place the cell on, and one for the top compress the octet. The geometry was assembled and imported into ANSYS. NinjaFlex, a viscoelastic 3D printing material, was used for the material properties. These properties consisted of the density, modulus of elasticity, Poisson ration, and Prony Series. Next the plates were meshed with 10mm hexahedral mesh elements, and the octet was meshed with 2.2mm tetrahedral mesh elements as shown in Figure 5.
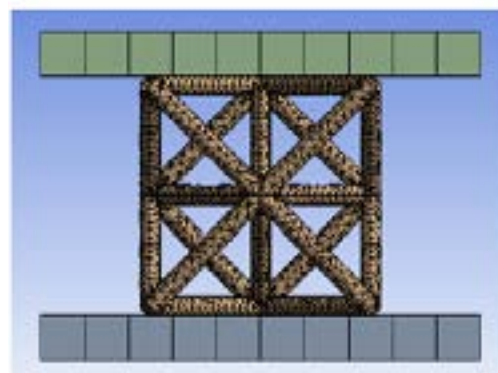

Figure 5 - Octet and plates geometry with mesh

The first analysis module was the Static Structural module. In this module, the base plate was fixed, the bottom of the octet was fixed to the base plate, and the top of the octet was fixed to the top plate. Next a 1N load was distributed evenly across the top plate to slightly compress the octet. The load and deformation are depicted in Figure 6.
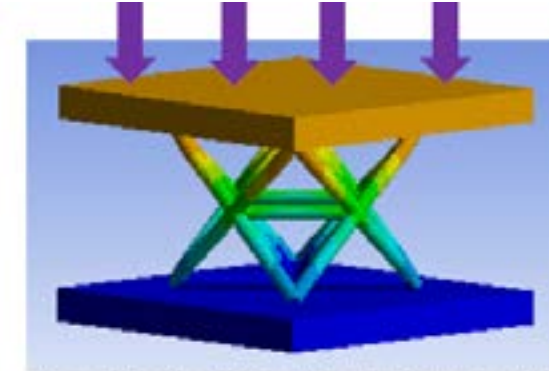
Figure 6 - Loads and deformation of simple 1N force. Blue indicates minimal deformation and red indicated maximum deformation.
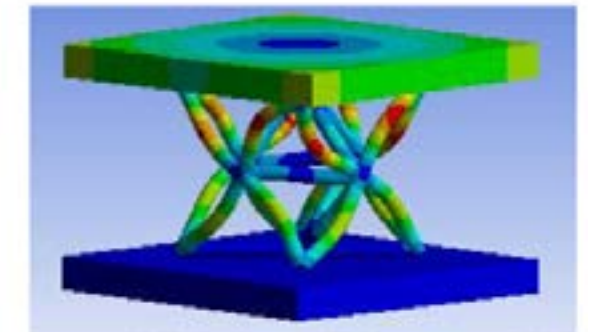
Figure 7 - The first buckling mode of the octet unit cell which occurs at 49.4N

The results from this analysis were used in the Eigenvalue Buckling module to determine how the structure would buckle. In this case, only the first buckling mode will occur. The octet buckles with a 49.4N load and the shape has a rotation of the faces as shown in Figure 7.

The third module was the Static Structural Post-Buckling module. Here the unit cell was compressed quasi-statically to 30% strain. The geometry used was the octet buckled geometry with deformation scaled to 0.0001. The base plate was fixed, and the bottom of the octet was fixed to the base plate. The plates and octet were defined to have frictionless interactions when they touched, preventing them from intersecting. The top plate was displaced downward, paused at max compression, then raised to the initial position.

This was repeated with the kelvin without buckling. The primary difference in this analysis was that there was only one Static Structural module used and no Buckling module. Additionally, the kelvin unit cell was meshed with a slightly smaller mesh size of 2mm. Otherwise, the analysis was the same.

This analysis was repeated for both unit cells in the lab. The unit cells were 3D printed out of NinjaFlex to the same size and volume fraction as the unit cells used in the ANSYS simulations. The unit cells were then compressed and unloaded on an Instron with a strain rate of 1s-1 to 30% strain, matching the compression in ANSYS.

First the deformation was compared visually between the computational and experimental results. The kelvin showed no buckling and matched very well for both methods as seen in Figures 8 and 9. The octet showed very similar buckling shapes with the faces rotating, but the internal members showed additional buckling in the 3D printed cell that was not present in the simulation as seen in Figures 10 and 11.

Figure 8 - Kelvin computational deformation

Figure 9 - Kelvin experimental deformation
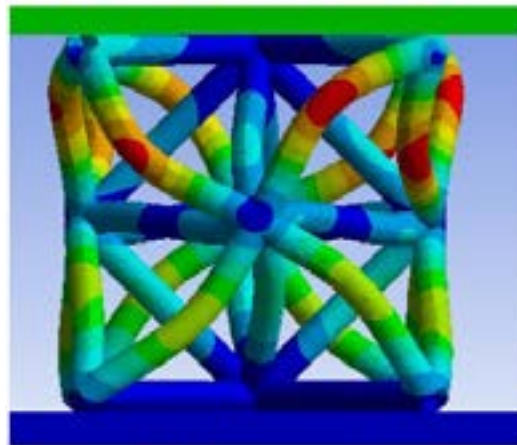
Figure 10 - Octet computational deformation

Figure 11 - Octet experimental deformation

Figure 12 - Experimental and computational results for kelvin and octet unit cells

	Kelvin			Octet		
	Experimental	Computational	Error (%)	Experimental	Computational	Error (%)
Energy Absorbed (J)	0.105	0.121	15	0.385	0.335	13
Modulus of Elasticity (kPa)	38.3	32.4	18	373	273	27

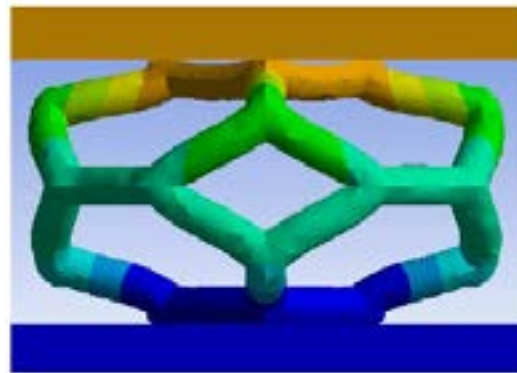Table 1 - Summary of results for both unit cells and comparison between experimental and computational methods

The stress versus strain plots for both unit cells from the ANSYS simulation and the in lab experiment are shown in Figure 12. The slopes of the initial rise on each plot is the modulus of elasticity for the unit cell and the area inside each curve is related to the energy dissipated by the unit cell. These values and percent error between the experimental and computational results are shown in Table 1. A higher modulus of elasticity means the material is stiffer and as expected, the octet has a higher modulus of elasticity for both the experimental and computational plots. The octet also has a buckling peak, while the kelvin only has a positive slope with no buckling peak. These features of the general shapes of the plots match the expected results quite well. For the energy absorbed there is less than 15% error between the experimental and computational results. For the modulus of elasticity of the kelvin there is 18% error. However, there is 27% error in the octet modulus of elasticity. The computational results show that it is much softer than the experimental results. This could be due to a discrepancy in the material properties entered into ANSYS since the material was modeled as isotropic without accounting for the grain of the 3D printing. Alternatively, it could be due to the difference in buckling shapes previously mentioned.

Conclusion

The octet and kelvin unit cells were used to characterize the energy absorption properties of bending and stretching dominated metamaterials. The analysis was done both computationally in ANSYS and experimentally with 3D printed unit cells. For the kelvin, the results showed good agreement in the deformation shape, energy absorbed, and modulus of elasticity. For the octet, the results showed good agreement for the general shape of the stress versus strain curve but there was some significant error in the modulus of elasticity with the simulated unit cell acting much softer than the 3D printed cell. This error could be due to material property or buckling mode differences. However, the general shapes of the stress versus strain curves clearly showed the predicted shapes for bending dominated and buckling dominated unit cells for both the experimental and computational results.

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Oxidative Stress and the Pathophysiology of Nitric Oxide due to Increased Diesel Emissions in the Inland Empire

Martinez Jairus

Jairus Martinez, Biology
Mentor: Dr. James J. Blair
Kellogg Honors Capstone Project

Figure 1: Map showing the advantageous geographic location of the IE in relation to the logistics industry. Image Southern California Association of Governments (SCAG).

Figure 2: Satellite imagery of the industrial developments surrounding the San Bernardino airport from 2005 (left) and 2016 (right). Images CGATI (ESRI).
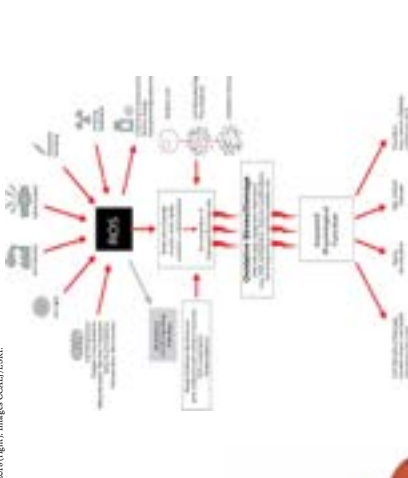
Figure 3: Schematic summary of how different sources create reactive oxygen species causing oxidative stress and molecular damage that leads to tissue damage. Image Protocol6 GmBH.

Figure 4: Comparison of the physiological and pathophysiological effects of NO in the respiratory system. Pathophysiological effects are closely tied to normal function of NO (Antosova et al., 2017, p. S163).

Figure 5: Schematic summary of how inhaled proinflammatory oxidants from pollutants react to induce the inflammatory response as carried out by inducible nitric oxide synthase (Ricciardolo et al., 2004, p. 744).
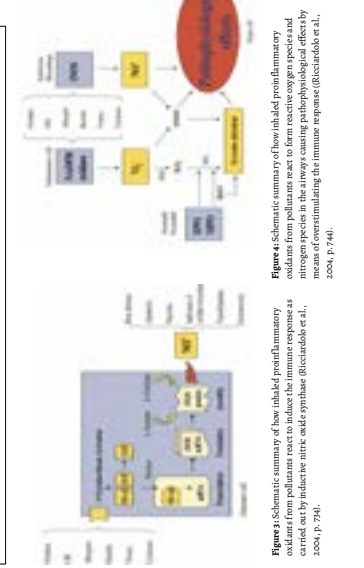
Figure 6: Schematic summary of how inhaled proinflammatory oxidants from pollutants react to form reactive oxygen species and nitrogen species in the airway causing pathophysiological effects by means of overstimulating the immune response (Ricciardolo et al., 2004, p. 744).

Resident Perspectives:

"When we first moved here, there was a lot of agriculture and undeveloped land - a lot of dairy farms, mosquitos, and flies."
- M. Stokes, Primary Educator and Life-Long Resident

"My most pressing concern is that we're going to lose the opportunity to continue our business because our landlord has sold this land to a warehouse developer. Even if we do stay, we would be this tiny 10-acre farming island in a sea of warehouses."
- R. Beilerdam, Farmer and Businessman

"There's a vague concern about the chemicals I breathe in the air...but yes, I'm sure. If I was more educated on it, I would be more concerned."
- K. Cooper, Physician and Professional Cyclist

"I wish air pollution and industrialization were talked about more - not only talked about more but something done about it."
- A. Vidaurre, Policy Coordinator and Life-Long Resident

"I think we're still too young to really see the effects. Most of us who started out in the warehouses are just 23-34, you know, so we haven't really seen the effects of what all this pollution is doing to us."
- E. Godinez, Warehouse Worker

"Educators need to be much clearer in creating the language that will help people to understand the effects of what air does to you."
- J. Nelson, High School Educator

"These community based organizations help to inform governmental organizations as to what's happening in their community and how it's impacting them. The policies that come out of these partnerships are usually a direct result of these types of grassroots advocacy."
- S. Tsung, Physician and Public Health Officer

Melgar
Jasmine

Ethics vs Aesthetics: The False Dilemma in Sustainable Architecture

Abstract

In this paper, I analyze the problem of duality between ethics and aesthetics in sustainable architecture and the resulting dilemma. I argue that the duality narrative is false and so is the dilemma because ethics and aesthetics are equally important and reciprocally dependent in architecture. The following are my claims: 1) three different views of architecture demonstrate that ethics and aesthetics are equally important, and; 2) various examples of the built environment demonstrate that ethics and aesthetics are reciprocally dependent. I also demonstrate that the lack of a unifying aesthetic in sustainable architecture is actually a reflection of the lack of a unifying ethical foundation for sustainable architecture. There are two objections that target each claim individually: 1) that duality and the dilemma do exist, and; 2) that a unifying aesthetics in sustainable architecture is impossible because a unifying ethical foundation is impossible. I answer that: 1) the objection supporting duality and the dilemma are based on a limited perspective of aesthetics, and; 2) a unifying ethical foundation is possible. I then review what my paper implies moving forward and conclude with lasting thoughts.

Introduction to Sustainable Architecture and the Duality Narrative

Throughout the history of architecture there have been different trends and styles that defined every era. Ancient Greece and Rome are known largely for their use of stone, arches, and columns; Imperial China is likewise well known for the use of tiled roofs with flared ends and heavy incorporation of red and yellow (specifically in regal structures). As one can imagine, aesthetic preferences were commonly significant to architectural design for centuries, but function and quality are the primary goals. From an ethical perspective these would have to take precedence for the sake of quality of life, but in our ethical pursuits are we obliged to abandon our aesthetic goals? This question has recently become of great importance in the architectural world due to the exponentially increasing concerns on climate change. Architects are now being ethically obliged to incorporate environmentalism into architecture through sustainability, following standards on minimizing use/waste of resources such as water and energy, minimizing costs, and so on (LEED Green building strategies).

With so many ethically driven demands to meet and decisions to make, there seems to be a decline in aesthetic prioritization; various architectural experts have claimed that aesthetic value is currently being entirely put on the backburner, or even left out entirely for the sake of ethical design choices. Examples of these attitudes are evident in most of my sources: "sustainability certification schemes do not encourage the development of…architectural aesthetics, which often remains ignored" (Daugelaite, Grazuleviciute-Vileniske Introduction); "some authors identify the negligence towards aesthetics…in the design of sustainable buildings and their assessment" (Grazuleviciute-Vileniske, et al. 79-80); "according to contemporary architectural theorists, the current changeable buoyant sequence of styles [in sustainable architecture] resulted in the complete loss of meaning and importance of architectural aesthetics….Three acclaimed professionals…were asked if there is such a thing as aesthetics in sustainable architecture today. All three answers were no….there is no consensus on what the possibilities of sustainable architectural aesthetics are or whether they exist at all." (Khetani 174). This creates a narrative of duality between ethical standards and aesthetic choices, and consequently poses the dilemma implied by the quotes above: aesthetics are being sacrificed for ethics. The reason aesthetics and aesthetic unity are so important is that these are representative of the attitudes and ideals of their designers: "loss of meaning and importance of architectural aesthetics….result in the loss of opportunity for expression and communication via architecture" (Khetani 174).

I primarily argue that aesthetics and ethics are equally important and even reciprocally dependent, thus disproving the duality narrative and eliminating the dilemma; the real reason for the lack of a unifying aesthetic in sustainable architecture is the lack of a unifying ethical foundation.

The first section of this paper will review the lack of a unifying aesthetic in sustainable architecture, explain how this leads to the assumption that aesthetics has no place in sustainability, and connect this idea to the perceived dilemma between aesthetics and ethics in sustainable architecture. In the next section I make the claim that aesthetics and ethics are equally important and reciprocally dependent in architecture; I support this first by providing three different views of architecture (as a social, a virtuous, or a learning practice) that demonstrate the equal importance of ethics and aesthetics, and then by providing examples of built environments that demonstrate reciprocal dependency between ethics and aesthetics. In the subsequent section I will reveal that the lack of a unifying aesthetic in sustainability is actually reflective of the lack of a unifying ethical foundation, which I will attribute to the inadequate education and emphasis on environmentalism. In the following section I will consider two main objections for the two claims in my thesis. The first objection targets my claim that ethics and aesthetics are equally important and reciprocally dependent: the duality narrative (and the resulting dilemma) does exist because, if circumstances forced the choice between style and function, an architect must ultimately be willing to sacrifice aesthetics. To this I reply that aesthetics isn't being sacrificed because the reciprocal dependency between aesthetics and ethics means that aesthetics in design is reflective of the ethical inspirations of a design, so the functionality of the design would produce a functionally-oriented aesthetic. The second objection targets my claim that (according to my view) a unifying aesthetic is possible through a unifying ethical foundation: a unifying aesthetic is impossible in sustainable architecture because a unifying ethical foundation is impossible; different communities around the world have different needs and preferences, and we lack sufficient knowledge for successfully developing unity. To this I reply that unity can be achieved through communication and respect, and research in sustainability has grown exponentially. In the remaining sections I will illustrate what my conclusions imply for moving forward, and why any of this information should matter to the average reader, before finally ending with some lasting thoughts.

Aesthetics vs Ethics: The Duality Narrative and the Resulting Dilemma

There is a wide variety of different styles present in sustainable architecture, varying between every design and their designers. Some common and yet contradictory styles include: industrialism; large volume minimalism; use of glass; modernist–functionalist; smaller scale, dynamics, and natural materials; postmodernist dynamics; use of curved lines; and ruralness (Daugelaite, Grazuleviciute-Vileniske Discussion and Conclusions). Industrialism uses elements typically found in structures designed for the industrial sector, such as the exposed beams and raw concrete found in warehouses. Minimalism is a dramatically simple style, emphasizing clear lines and geometric features as is done in The Glass Pavilion at Montecito CA. The phrase "modernist-functionalist" refers to architecture that is designed solely around the intended function of the structure while also including innovative technologies and techniques, much like many contemporary hotels and office buildings. Dynamics refer to the fluidity and change in form/shape (especially over time) of a structure, and postmodernist dynamics oppose modernist simplicity with innovation and imagination as is evident in the Walt Disney Concert Hall in Los Angeles.

With all of these different styles present in sustainable architecture, there is no prominent style that can be considered a unifying aesthetic in sustainable architecture. As mentioned in the introduction, having a unifying aesthetic is important because architectural aesthetics are how designers communicate their attitudes and ideals (Khetani 174). Without a unifying aesthetic, architects are left to assume that aesthetics simply have no importance in sustainable architecture; even the most prominent voices in architecture have begun to agree that there is no definitive aesthetic or style to be found in sustainability (Grazuleviciute-Vileniske, et al. 79). Ethical obligations have definitely pushed architects to prioritize pragmatic aspects of design over aesthetic decision making, especially for the sake of sustainability.

The Disproving the Duality Narrative for Coexistence

In the first section I reviewed the many different styles in sustainable architecture and how the lack of a unifying aesthetic lead to the narrative of duality between ethics and aesthetics, which implies that there's also a dilemma between them. In this section I argue that ethics and aesthetics aesthetics and ethics are equally important and even reciprocally dependent, thus disproving the duality narrative and eliminating the dilemma. Equal value between ethics and aesthetics is evident from the three different ways architecture can be viewed: as a social practice, as a virtuous practice, and as a learning practice (Collier 3-5). As a social practice, design considerations in architecture must be made according to who the building is for, what their needs may be, and what would be desirable/representative of the community the structure will reside in. According to this view, architects must consider equally: their ethical obligations to the community's needs; and the aesthetic values that properly demonstrate a representation of the community and their desires. As a virtuous practice, design considerations in architecture must be made to produce objectively good outcomes and have objectively good intentions. According to this view, architects must consider equally: their ethical obligations to producing objectively good intentions and outcomes; and the aesthetic values that properly demonstrate these objectively good intentions and outcomes. As a learning practice, design considerations in architecture

must be made to unite knowledge gained from experience and problem-solving insight. According to this view, architects must consider equally: their ethical obligations to unite knowledge from experience alongside problem-solving insight; and the aesthetic values that will demonstrate this unity of knowledge and insight. Each of the three ways to view architecture incorporate ethics and aesthetics in a way that they are equally important.

Regarding the reciprocal dependency between ethics and aesthetics, there are many examples of built environments that demonstrate both the dependence of aesthetics on ethics and the dependence of ethics on aesthetics. Ethicism claims aesthetic quality depends on whether the structure evokes significant ethical response from viewers, implying that the ethical quality is actually important to aesthetics (Collier 2-3). Aesthetics in architecture have historically been reflective of the ethical values of the societies that existed at the time and location of a structure, implying that aesthetics depend on ethics. Many structures, especially ancient buildings such as the Pyramid of the Sun in Teotihuacan or St. Basil's Cathedral in Moscow, were built within societies that wanted them large and tall with ornate features to reflect the grandness of their deities and the beauty of the heavens. Following WWII, the emergence of "cookie-cutter" houses in the U.S. was a result of the surging number of people in need of immediate and affordable housing that would not only support the sought-after "nuclear family" but also preserve contemporary ideals (patriarchy, conformity, racial segregation, etc); these homes were designed to satisfy each requirement with cheaply sourced materials, simple design, and assembly-line style mass production.

Ethical values in architecture are also at times dependent on aesthetic preferences. Often the central arguments on urban planning and architectural design focus on one concern: preserving the signature look of an area. This may be for the sake of culture, history, or even just tourist appeal, yet all are equally important in developing an ethics framework for architectural regulations. For example, the French Quarter in New Orleans is just one of many areas where local government has put certain policies in place that will not only protect the pre-existing aesthetic elements (no demolition, no replacements, etc), but prevent any individual(s) from compromising these with added elements (no major structural/decorative additions, keeping up appearances, etc). Therefore, there are many cases in which aesthetic preservation directly influences the ethics behind policies and regulations.

It has been proven time and again that aesthetics and ethics are interwoven in architectural design, and yet the duality narrative (which I've shown to be false) prevents architects from recognizing this important concept. This creates dissonance not only within the architects themselves and their designs, but also within the architectural community at large. Even architectural researchers agree that "the cultural dimension (including aesthetics and the sense of place) is increasingly becoming a part of the concept of sustainable architecture and sustainable building" (Grazuleviciute-Vileniske, et al. 82). As mentioned in the first section, perceiving aesthetics and ethics as being in conflict drives architects to assume that there is no room for aesthetics in sustainable architecture. This has negatively impacted the development of sustainable architecture by restricting the potential for the innovation necessary to develop a unifying aesthetic

Lack of a Unifying Aesthetic Explained

In the first section I reviewed the many different styles in sustainable architecture and lack of unifying aesthetic, and my argument explained that aesthetics and ethics are of equal value and reciprocally dependent. As a result, I can conclude that aesthetic styles used in sustainable architecture are actually reflective of the variety of ethical ideals found in sustainability. Depending on what ethical ideals a given architect incorporates, a single design can include multiple different elements that greatly impact aesthetic potential. Three sets of clashing architectural approaches to sustainability contribute to the lack of distinct aesthetics: Technophilia and Technophobia; the Prescriptive and Holistic approaches; and prefabrication versus biomimetics/biomimicry. In each set there is a divide between technology and organics, and in the aforementioned order they increase in comprehension and scale. Technophilia prioritizes gadgets and accessory, whereas technophobia has a tendency towards eco-centric and passive design; a prescriptive approach emphasizes frameworks and analytics while a holistic approach incorporates conservation, efficiency, and regeneration; the prefabrication approach is based in standardized, modular construction, contrasting the "back to nature" theme found in biomimetics/biomimicry that encourages emulating elements from the natural world (Khetani 174-177). An architect may incorporate an abundance of modern technological features (solar panels, thermal-regulated glass, etc) in a design in order to meet resource and waste goals. Another architect may instead opt for a naturalistic approach in an attempt to reduce the carbon footprint of their design, and to have it blend in with the surrounding natural environment (such as the Firefly Eco Lodge in Bali). In this same way, while many architects will look to avoid unnecessary use of synthetic materials, some will decide to apply a raw look (such as the Cathedral of Our Lady of the Angels in Los Angeles) and others will prefer a rustic appearance (same intention, entirely different results).

The variety of ethical ideals that produce these different approaches reflects a lack of a unified ethical foundation for sustainable architecture; I will here attribute this to the lack of education and emphasis on environmentalism. As much as there are many responsibilities to consider in architecture (cost, durability, etc), the definition of sustainability has been largely determined by the degree of ethical consideration for environmentalism; unfortunately, environmentalism has been treated much more as a secondary consideration that encourages seemingly last-minute edits to designs for the sake of meeting standards of "sustainability". This lack of focus on environmentalism translates to a lack of ethical foundation because the ethical consideration for environmentalism determines how we define sustainability. Sustainability is thus treated more as a set of standards that pre-existing designs must adjust to, rather than a core value to derive a design from, because it is much easier to adopt styles and trends from pre-existing designs than to try and curate entirely new ones (Khetani 173-174).

Despite all the concern for the future of the planet and the understanding of the impact architecture has on climate change, environmentalism is evidently still undervalued and only loosely incorporated in designs. This results from a variety of particular issues, beginning with education. There is difficulty in developing and teaching a general, flexible, all-inclusive definition for sustainability in architecture, and many architects have not received enough education in environmental issues. They tend to lack a structured approach to designing sustainably that will incorporate universal goals (ex. affordability, and even lack the information necessary to even try developing such an approach. Architects are thus unable to be innovative and inspired for the sake of aesthetics because they still have yet to create the necessary ethical foundation (Conte 3-5).

Objections and Replies: Duality and Unity

Now that I have demonstrated how ethics and aesthetics aesthetics and ethics are equally important and reciprocally dependent, and explained that the lack of a unifying aesthetic in sustainable architecture is a result of the lack of a unifying ethical foundation, I will consider two main objections for these two claims.

The first objection is that the duality narrative (and the resulting dilemma) does exist because, if circumstances forced the choice between style and function, an architect must ultimately be willing to sacrifice aesthetics. Dr. Gasdaglis, a professor of philosophy, posed a thought experiment along these lines: "If somehow the circumstances led an architect to the choice between a design with an ornate style that isn't functional or a design with a dull style that is functional, which design should the architect use?" The architect would be forced to choose the dull but functional design, because (as mentioned in the introduction) function and quality are the most fundamental goals of architecture, thus proving that there is duality and a dilemma between ethics and aesthetics. To this I reply that aesthetics isn't actually being sacrificed, but it is being viewed from a limited perspective. The reciprocal dependency between aesthetics and ethics that I argue for imply that aesthetics in design is reflective of the ethical inspirations of a design, so the functionality of the design would produce a functionally-oriented aesthetic. From this I can conclude that dullness is an aesthetic quality and can be aesthetically pleasing, as long as one's aesthetic preferences include dullness.

The second objection is that, since I claim that the lack of a unifying aesthetic in sustainable architecture is reflective of the lack of a unifying ethical foundation, one may conclude that a unifying aesthetic is possible as long as a unifying ethical foundation is possible; a unifying aesthetic is impossible in sustainable architecture because a unifying ethical foundation is impossible.

A unifying ethical foundation is impossible because aesthetics and ethics vary among communities even within the same cultures and regions, and a common stance will likely never be reached due to the specific but significant differences. While in certain areas people may be accepting of towering buildings and crowded spaces (large cities, multi-use communities, etc), other areas may have strict policies against such architecture due to functionality and culture (rural areas, conservative or indigenous communities, etc). For example, on the east coast of the US there are various buildings that are multifunctional, with multiple stories that may serve as office spaces, places of business, and even living quarters; such buildings will not be found in many other places in the country due to regulations on building height, zoning, and urban planning conflicts.

Likewise, a unifying ethical foundation is impossible because sustainability is new and, according to my previous section, in need of much more development. While there may be conclusions in science about climate change and our part in it, some argue that we lack scientific conclusions on how to approach solutions; for example, there has not been enough research on different materials, their advantages and weaknesses, or the long-term effects of their use in sustainable architecture (mushroom insulation, zero-carbon concrete, etc).

As for the first part, a common stance can be achieved through learning, communication, and open-mindedness. In spite of this, their differences definitely ought to be respected and accounted for within that stance, meaning it would have to be a set of flexible and widely applicable standards. While many agree that lasting change in the world requires a significant cultural shift (Conte 1), this shift should by no means exclude or move against the core values of different societies. For example, despite the plethora of limitations on improvements in sustainable design, the primary elements of sustainable architecture in Japan are influenced by the traditions and values of the country (Sunikka-Blank 186, 194). Necessary changes for the sake of sustainability can be made without disrupting the core cultural structures of a given society, and further international communication must take place to resolve what changes ought to take place where and how. Regarding the second part, the lack of development and research has been and always will be a concern; however, just as the world continuously advances in technology, so too will sustainable architecture improve. Over time the world has gained information to provide more structure for environmentally conscious design, helping designers understand what methods work best and what materials are suited for which purposes (Conte 2). For now, we have made at least enough progress to make significant steps forward, and progress has grown exponentially from the very beginning. As mentioned, there are quite a variety of materials and methods we may apply today and understand to be effective and efficient. Likewise, there have been countless societies throughout history that developed their own methods and were able to rely on the results for many generations, especially indigenous societies from various regions.

While these are all valid concerns, they are actually much less complicated than they may seem at first glance. We must remember that sustainable architecture is still in its early stages, stages of experimentation and diversity, and has not pushed far enough for one single particular aesthetic to arise from it; however, there is potential in bridging the gaps between the conflicting approaches (Khetani 179). There will continue to be issues that need addressing, but we should not be discouraged from seeking solutions.

Implications and Moving Forward

Moving forward, much more discourse is necessary on this topic. The more architects communicate with engineers, scientists, designers, and governing authorities, the better the progress in sustainable architecture will be. The ethical obligations of a design will drive aesthetic innovation, and likewise aesthetic innovation will contribute to the establishment of ethical standards for design. There may still be concerns and apprehension about the future of sustainable architecture, and in the future it is possible that new research may lead us to realize we have made mistakes along the way, but stumbling forward for the sake of our

survival is a much better alternative to remaining still as the world crumbles around us. This goes for every area of design, engineering, and especially industry; environmentalism must be the primary concern in design, and sustainability the primary goal in the product. Aesthetics and ethics can and will coexist in sustainable design, and the result will be a future for humanity that goes beyond imagination.

This may seem far-fetched, and many people will certainly feel detached from these concerns; why would the average person have to worry about ethics and aesthetics in sustainable architecture?. They must make note, however, that these issues will affect every aspect of their lives. From where they sleep to where they work, the ways they travel and the habits they develop, the very dynamics of their daily lives are all affected by the future of architecture, and for everyone's sake they had better hope it to be sustainable architecture. I would hope that everyone can agree that structures should have greater efficiency in resources (temperature regulation, water filtration, etc), a more psychologically beneficial atmosphere in general, and little to no harm done in any and all steps of their construction. Office buildings will be more comfortable and much less stressful, homes will serve their inhabitants better, and public buildings will be much more inviting and practical. We will all be satisfied ethically and aesthetically, andour quality of life will increase almost miraculously. One could call it almost utopian, and yet it can almost certainly become a reality.

Thoughts on Unity and Progress

I begin the end of this paper with a reflection of each section. In the first section I reviewed the issues of aesthetics vs ethics in sustainable architecture, particularly the lack of unifying aesthetics and differences in prioritizations. I then offered a possible explanation for these issues, being that there is a lack of a common stance on design styles and sustainability and that environmentalism is not being prioritized enough. In the next section I argued for the coexistence of aesthetics and ethics, explaining first how ethics influences aesthetics and then vice versa in order to demonstrate a mutual relationship between the two. In the third section I consider some objections to my assertions that point out lack of development and concerns about the involvement of different cultures and regions, and respond accordingly with sympathy and practicality. At last, I reviewed some broader implications as to how we must move forward and why these issues hold so much weight as to become concerning for individuals.

My hope is that people will at the very least seek education, learn to see through such false dilemmas, and be encouraged to prioritize environmental sustainability in as many aspects of their lives as often as possible. We may redefine aesthetics and revise our ethical decisions endlessly; as long as the core of our considerations are sustainability we will be headed in the right direction. There can never be enough progress, and we can always look ahead for ways to move forward; we must not only mend the issues we face now but also actively develop effective foundations for preventing issues and making improvements.

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Mendez Natali*

Dr. Bonny Burns-Whitmore

Comparison of Dietary Protein and Exercise Patterns vs Supplemental Protein in CPP College Students

Abstract

There has been an interest in restrictive diets such as low-carbohydrate and high-protein diet, the Mediterranean, and the vegetarian diet which eliminates all meat and animal products for quite a while now. Research shows that plant-based diets are a preventative healthcare solution and can reverse chronic diseases such as diabetes, cancer, and heart disease (Tuso 2013). Plant-based diets and a healthy lifestyle incorporating physical activity are suggested to contribute to a consumer market growth of protein supplementation. In this study, our goal was to examine college students' dietary protein intake (including whole plants and animal sources) and exercise patterns on protein supplements (including powders (shakes), sport bars, and amino acid supplements). Quantitative analysis of the 15-question survey was performed using RedJade Sensory Software. Results revealed nonsignificant protein supplemental use among college students who exercised and follow an animal-based product restricted diet. 12.3% of participants are vegetarians or vegans, but in all categories of protein supplementation, the majority (50.0%) have never consumed animal-based protein supplements (e.g. whey, casein) and 31.7% for plant- based protein supplements (e.g. soy, pea). Regarding exercising patterns, 79.6% do exercise and majority (65.3%) exercised 3 or more times per week. Thus, the small sample of participants who followed an animal-based product restricted diet and exercised showed no correlation to a higher protein supplementation intake as hypothesized.

Major Objectives

To assess dietary and exercise patterns and the use of protein supplementation and to collect information on college student's diet, exercise, and supplementation patterns.

Background research with analysis and literature review

Since the first liquid-based diets in the 1500s, other diets have appeared in many forms (Wdowik 2017). Today, we often hear about restricted diets like the ketogenic diet or low-carbohydrate and high-protein diet, the Mediterranean diet, pescatarian, vegetarian, vegan and much more. There are many reasons for the popularity of these diets, but primarily due to their quick-fix, cleansing, weight loss, or disease prevention presumed benefits. The ketogenic diet is a low- carbohydrate, high-fat diet that is most promoted for people with diabetes and epilepsy and supported by research that has shown its association with weight loss, insulin resistance, and lowering blood pressure (Abbasi 2018). Research on the vegetarian diet has shown it to function as a preventative healthcare solution and to reverse chronic diseases such as diabetes, cancer, and heart disease (Tuso 2013). Like the vegetarian diet, other restricted diets of animal sources are increasing in popularity as research focuses on their unlimited benefits.

However, just as there are research studies that reveal new discoveries and treatments, there are others that disapprove them and show inconsistent results. Restricted diets have been proven to lead to nutrient deficiencies of protein, calcium, vitamin B-12, and iron (Clarys, et al., 2014).

Today, one of the most restricted food products are animal sources. Animal sources contain high quantities of readily digestible protein and micronutrients that are solely provided in such high amounts by foods of animal origin. Plant sources are high in fiber, vitamin, and minerals, but are an incomplete source of protein meaning they lack one or more of the nine amino acids. Plant- based protein is an incomplete protein source that typically takes longer to digest and provides less protein value versus animal-based protein is complete protein and will provide more protein value.

In this study our goal was to evaluate college students' dietary protein intake and exercise patterns from plants and animals, and protein supplement use. Exercise was included because protein has long been associated with athletic performance. High protein diets are promoted intensively by the fitness and nutritional supplements industry as "the gold standard" for muscle development and fat loss (Delimaris, 2013). Protein is essential for the build and repair of body tissues, proper growth, and metabolic reactions. However, is the consumption of protein, higher than the Recommended Daily Allowance, through dietary sources or protein supplements more prevalent with special diets like the vegetarian and a lifestyle that includes exercise?

The US Recommended Dietary Allowance (RDA) for protein in all individuals of age 19 and above is 0.8g/kg/day. The Academy of Nutrition and Dietetics (AND) and the American College of Sports Medicine (ACSM) recommends athletes to consume a protein intake between 1.2 and 2.0g/kg/day to preserve lean body mass and endurance (Thomas, et al., 2016). Depending on other factors such as age, weight, pregnancy, and illness, as well as goals of weight maintenance, weight loss, or muscle gain, we see the required daily protein intake change. What has not been found to differ is the protein requirements for healthy adults when consuming predominantly animal or plant protein sources. Many people are unaware of complementary proteins (e.g. combining beans, seeds, nuts and grains) and of how much protein they are actually consuming from protein-rich products that do not come in a meat form.

According to the 2001-2014 National Health and Nutrition Examination Survey (NHANES), most of the US adults aged 19–30yrs exceed the minimum recommended protein intake by 88.2 ± 1.1 g per day (Berryman). According to Grand View Research Inc., the global protein supplement market is expected to grow 8.4% as the soaring sales of protein supplements increase every year (Grand View Research, 2021). Protein products in the forms of bars, shakes, and powders are now found in abundance in supermarkets and convenience stores due to their high demand. Thus, the presumed necessity to buy protein supplements exists; but is it due to the animal-source restricted diets becoming more appealing and popular? The hypothesis is that individuals who are vegetarians or follow an animal-based product restricted diet and exercise are more likely to consume protein supplements.

Methods

A total of 124 out of 260 participants were included in the study. Participant eligibility for the study was based on age, must be 18 years or older to participate, and a current California State Polytechnic, Pomona student. Subjects were recruited via email sent by the College of Education and Integrative Studies, College of Agriculture, and College of Business Administration. Those interested in participating in the study were able to assess the RedJade survey questionnaire link that was in the email. Data was qualitatively analyzed using RedJade Sensory Software. The survey questionnaire collected information on college student's diet, exercise, and protein supplementation patterns through frequency questions.

Procedures were reviewed and approved by the Institutional Review Board at Cal Poly Pomona (IRB #21-171) before the start of the project.

Results

In the data analysis, each individual question was analyzed.

It was revealed that 90 (80.3%) out of the 124 participants were omnivores (Chart 1). A total of 15 (12.3%) participants reported following a plant-based diet, either vegetarian or vegan diet.

Chart 1.   Chart 2.
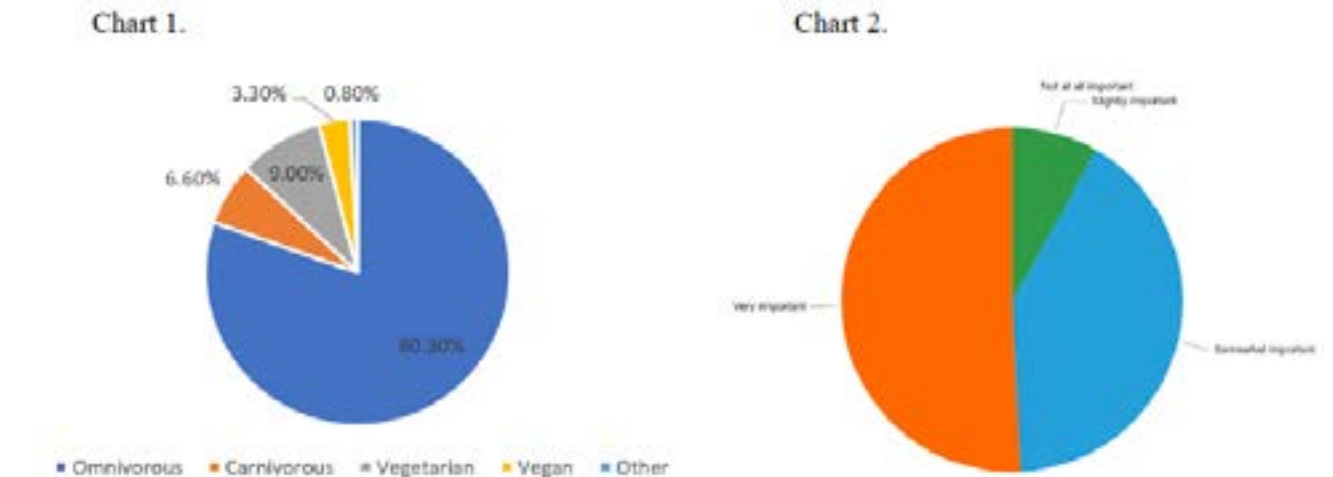
To the question "How important is protein in your diet?", 50.8% answered very important, 41% somewhat important, 8.2% slightly important, and 0% not at all important (Chart 2).

When asked to estimate the average food intake of each protein source for the answer '1-3 times per week', the consumption for red meat (33%), poultry (34%), dairy (30%), and eggs (28%) predominated all other frequency rankings. For plant protein sources, legumes (27%), non-dairy milk (21%), grains (26%), and plant-based protein supplements (11%) were reported to be consumed as frequently as 1-3 times per week.

A total of 80% of participants exercise. The majority (35.7%) exercise 3-4 times per week, 29.6% exercising every day, and only 14.2% rarely exercised. Participants number one purpose for a high protein diet was for muscle gain (31%) and secondly for energy (20%) (Chart 3).

Chart 3.
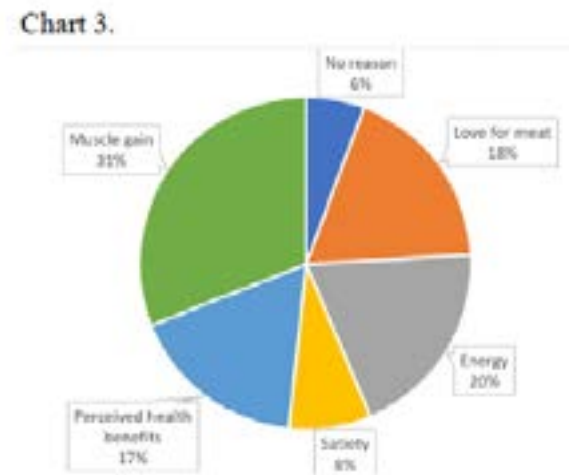
From the question that measured the average food intake of each protein source, all protein supplement sources provided (animal-based powder, plant-based powder, ready-to-go shakes, sport/protein shakes, and amino acid pills), the responses of rarely and never were most popular (Chart 4). Thus, rejecting my hypothesis that individuals who follow an animal-based product restricted diet and exercise are more likely to consume protein supplements.

Chart 4.
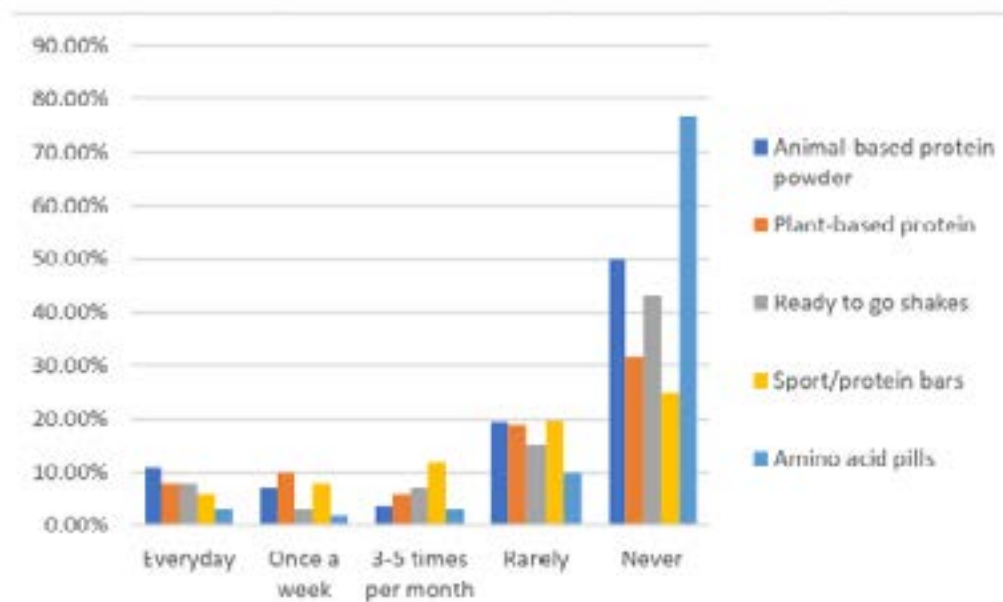
Discussion

Overall, the results showed that protein supplements were not as popular as hypothesized. The hypothesis was rejected as individuals who follow an animal-based product restricted diet and exercise showed no correlation to more likely consuming protein supplements. Participants who were vegetarians or vegans (12.3%) in all categories of protein supplementation, the majority answered that rarely or never for consumption. Despite the trend of plant-based diets, most student participants were omnivores (80.3%). Surprisingly, fish consumption was a relatively high and the top 3 purposes for a high protein diet were muscle gain (56.3%), energy (35.4%) and for the love for meat (33.3%). Still, the majority do not consume protein supplements in their protein rich diets. 67.8% do not know the recommended protein intake which was worrisome and might have led to incorrect question responses.

These findings can be used as a foundation for future studies following dietary trends amongst college students and for general educational purposes on the different protein sources (animal- and plant-based).

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Mendez   **The Breakfast Bar Study**
Natali

Abstract

In this study, a comparative analysis of nutritional constituents of 40g of 14 commonly consumed breakfast bars, also known as cereal bars, was performed. The research question is, "Is there a clear difference in nutrient composition between 40g of commonly consumed breakfast bars that contain nuts (peanuts/peanut butter) and chocolate, and a Snickers candy bar that also contains nuts (peanuts/peanut butter) and chocolate?" The Snickers bar is added in this study serving as the main comparison product which ultimately all bars will be compared to, revealing if there is a clear difference between two "opposite" bars. This was a two-part study involving (1) the nutritional comparison of the breakfast bars to the daily values and the Snickers bar and (2) a survey to determine college student's perspective on healthy products and frequency of consumption.

Results from the survey showed that the majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently. The survey also revealed that 58% have replaced a breakfast bar for a meal but, only 16% have replaced a meal with a candy bar. The student responses also helped to determine that the healthiest bars, Fiber One Chewy Bar, Chocolate Peanut Butter and Clif Kid Z Bar, Peanut Brownie were those that contained the least amount of total lipid, saturated fat, and sugar. From the nutritional comparison, the Snickers bar showed to not be significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content. Lastly, none of the bars met the nutrient's daily values for breakfast assuming that people are consuming 1/3 of their daily values.

Major Objectives

We assessed the nutritional value on twelve selected nutrients in the breakfast bars for an overall value analysis and an evaluation of the difference between them all. Research question is, "Is there a clear difference in nutrient composition between 40g of commonly consumed breakfast bars that contain nuts (peanuts/peanut butter) and chocolate, and a Snickers candy bar that also contains nuts (peanuts/peanut butter) and chocolate?" The first null hypothesis is that there will be no nutritional difference between the Snickers candy bar and the breakfast bars. The second null hypothesis is that people will be receiving 1/3 of their daily values (DV) in the breakfast bars. The secondary part of the study is a survey. The purpose of the survey is to determine the frequency and nutrient details that control the consumption of breakfast bars, to learn college students' perspective as to what makes a product healthy, and which bar(s) is/are the healthiest. The null hypothesis for the survey is that students will have no consensus as to what makes a breakfast bar healthy.

There are only a few studies that have done a comparative research like this one; therefore, this study will enhance the consumers nutritional knowledge of breakfast bars and increase healthier choices in the future. The consumption is commonly influenced by the nutrition labels, therefore by analyzing and comparing the nutrition labels, using SPSS, of the bars I will reveal if having a candy bar for breakfast delivers the same energy and nutrients as a breakfast bar.

Consumers will benefit from this study and its results by understanding that these bars aren't as beneficial as assumed. Consumers will also be able to see which breakfast bars are the most nutritious and which are the least from the comparisons of nutritional constituents.

Background

Traditionally, a breakfast was either eggs with bacon, oatmeal, toast with jelly, or potatoes. Due to changes in people's lifestyles, specifically mismanaged situations and busy work schedules, a traditional breakfast seems too not be quick enough. Today, a meal has shifted to last-minute throw together incomplete meals. The time to prepare and eat a breakfast meal can be a luxury that many of us do not have. In a day that often begins with a rushed morning and is spent at work or school and not at home, prior to the COVID-19 pandemic, a light meal or on-the-go snack is more feasible (Sharma, Kaur, Aggarwal, Singh. 2014).

Breakfast is often called "the most important meal of the day." Breakfast serves as the first opportunity to give your body the correct nutrients and energy for the long day to come. So, how can you have a breakfast that promises to be healthy, energy- and nutrient-rich, while at the same time easy as grab and go? The food industry came up with breakfast bars, also known as cereal bars. And not surprisingly, serving as one of the most innovative products in the food industry today, bar brands have successfully produced over 900 different bars that keep up with the consumers' demands. Rising rapidly, these bars that are classified into four types: fiber bars, energy bars, diet bars (light), and protein bars, have showed a 11% consumption increase in 2007 and globally, an average growth of 20% each year (Sharma, Kaur, Aggarwal, Singh. 2014).

Food industries and companies that are in the market of developing breakfast bars are constantly creating newer products promising consumers that there brand bar is the healthiest and the best option for our breakfast. An attractive wrapper that says to be "all natural", "no sugar added", "high protein", etc. can encourage buying, but also be misleading. Popular for their convenient, ready-to-go nutrient and energy packed package, specific breakfast bars also have a preserved health improvement, weight loss, and disease prevention component determined by their ingredients. Now the problem is because breakfast bars can act as a meal replacement, a dessert, a weight loss product, or a snack between meals; there is a concern about them being consumed at a higher frequency than actual well-balance meals and nutritious wholesome snacks. Consumers consuming breakfast or cereal bars are often not looking at the ingredients list, doon't know the nutritional value, or which bar is the best fit for their specific needs (Constantin, Istrati. 2018).

Most of the time, as mentioned previously breakfast bars are consumed for the quick fuel it delivers or as a snack alternative, but are the nutrition claims and the nutrition fact label on their wrappers true? If the purpose of consuming a breakfast bar is to serve as a meal substitution, do consumers know that many breakfast bars do not have enough calories and nutrients to serve as a breakfast meal? Or do consumers know a high number of breakfast bars have the same calories as a Snicker's candy bar? If this were true, why aren't people substituting a chocolate bar for a breakfast meal? The reason can be due to lack of nutrition knowledge or that nutritional facts labels are often misunderstood when purchasing any food item. Instead consumers rely on the nutrition claims that are on the packaging as the determining source if to buy or not buy that product.

An example of how important it is to choose the correct bar for each individual is the drawbacks with energy bars. Originally created for athletes and marathoners, energy bars provided that almost instant fuel that they needed before a workout or game. However, today a higher usage of energy bars is reported among students, office workers, and people who are dieting and/or exercising (Klein, 2007). Branded as ready-to-eat bars that deliver high energy, and can serve as weight loss aids, these products mislead many consumers and are the cause of malnourishment and heart diseases. The making of breakfast bars with a nutrient-rich composition that gives all its consumers the right amount of fiber and nutrients in one bar is difficult. Not everyone requires the same energy intake or exercises; thus, it is important to educate consumers in looking for breakfast bars and other food products that best fit their personalized needs.

This research is important for the science of health and wellness. Consumers are unaware that many breakfast bars contain: (1) more added sugars than they believe, (2) lack fiber, (3) that energy means calories, and (4) more protein in a bar is often not beneficial if they are exceeding the DRI. Some bars are low in calories, but there are others that have as much as 350 calories or more which is close to the 400-calorie target that a breakfast meal should consist of, if the person is consuming three meals a day and is on a 1200 calorie diet. To serve as a snack, some breakfast bars have more calories than what a regular snack should have meaning at the end of the day, the consumer would be consuming more calories in a smaller portion, leading to weight gain. Making nutrition information accessible and understandable will help consumers determine which bars are most suiting their needs and get them to look past the "high protein," "low carb," and "low calories" labels, but instead the ingredients list and nutrient composition.

Methods

For the first part of the study in the nutritional analysis, a total of 14 different nutrition bars were collected, all found at grocery stores and retail chains, gas stations and convenience stores where people commonly buy food on the go. The names of the nutrition bars that met the criteria of containing nuts and chocolate were listed in an Excel spreadsheet in which information on the nutritional value of these bars was collected such as the energy in kcal, fat, carbohydrates, sugar, protein, fiber, etc. Bars that did not contain one of the two main ingredients in a Snickers bar (peanuts/peanut butter and chocolate) and those that fell under another type of bar (e.g. protein bar or energy bar) were eliminated. Nutritional data for the comparison of nutritional values between all bars and the Snickers

candy bar was obtained from the Food Data Central (formerly known as the USDA Nutrient Database) and the nutrition labels.

One sample t-tests were used in SPSS version 27 to assess statistical significance using an alpha of 0.05. All the bars were normalized to 40g, the FDA's reference amount for grain-based bars, to determine the comparison to the Daily Values.

For the second part, subjects were recruited through e-mail. Those interested in participating in the study were able to assess the RedJade survey questionnaire (IRB# 20-215) link that was in the email. The questionnaire was specifically developed for this study which consisted of questions on demographic characteristics, preferences of breakfast bars, frequency of consumption, and which ones were the healthiest based on what they believe makes a food product a healthy choice. This questionnaire resulted in a total sample size of 260 students.

Results

Part 1. Nutritional analysis

The mean of all 14 breakfast bars' nutrients to the Snickers' nutrient values in a one sample t-test revealed that there is no significance between all bars in total fat, carbohydrates, calcium, potassium, and total saturated fat (sig. p>0.05) (Table 1). The Snickers bar showed to not be significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content (sig. p<0.05) (Table 1). However, when compared to the Snickers bar, the energy, protein, fiber, sugars, iron, sodium, and cholesterol content are significantly different.

In the comparison of breakfast bars (without the Snickers) to the DV of the twelve nutrients, a one sample t-test demonstrates that the Snickers bar does not contribute to the significance difference of the compared nutrients and that none of the breakfast bars including the Snickers bar meets the Daily Values for a breakfast assuming that the person is consuming 1/3 of their Daily Values for the day for breakfast (Table 2). None of the bars meet the nutrients daily values for breakfast assuming that people are consuming 1/3 of their daily values (Table 2 and 3).

Table 1. Comparison of Breakfast Bars Mean Nutrients to Snickers Bar

Breakfast Bars (N Snickers [1]	Mean (Standard	t value	Mean Difference	Confidence Interval	Sig. p<0.05
Energy	196.4	174 (19.5)	-4.39	-22.9	(-34.2, -11.6)	0.001
Protein	3	4.4 (2.2)	2.41	1.4	(0.14, 2.69)	0.032
Total fat	9.5	7.7 (3.6)	-1.8	-1.8	(-3.86, 0.35)	0.095
Carbohydrates	25	23.7 (4.7)	-1.01	-1.3	(-3.94, 1.43)	0.331
Fiber	0.9	3.6 (2.9)	3.36	2.7	(0.96, 4.51)	0.008
Sugars	20	10 (3.1)	-12.3	-10	(-11.8, -8.28)	<0.000
Calcium	37.2	38.5 (44.9)	0.11	1.3	(-25.8, 28.4)	0.917
Iron	0.26	1.1 (0.3)	10.9	0.8	(0.65, 0.97)	<0.000
Potassium	129	132 (37.6)	0.29	3.06	(-19.6, 25.8)	0.774
Sodium	96	129 (45.8)	2.72	33.4	(0.89, 59.8)	0.017
Total Saturated	3.6	4 (1.9)	0.49	0.26	(-0.89, 1.40)	0.634
Cholesterol	5.2	0.07 (0.2)	-77	-5.1	(-5.28, -4.99)	<0.000

[1] Snickers is represented as actuals

Table 2. Comparison of Breakfast Bars (without the Snickers) to the Daily Values of the Nutrients

Breakfast Bars (N=14)	Test Value	Mean (Standard	t value	Mean Difference	Confidence Interval	Sig.
Energy	667.67	173.5 (19.5)	-94.731	-494	(-505, -483)	<0.000
Protein	16.7	4.4 (2.2)	-20.835	-12.3	(-13.6, -11.0)	<0.000
Total fat	26	7.7 (3.6)	-18.729	-18.3	(-20.4, -16.1)	<0.000
Carbohydrates	91.67	23.7 (4.7)	-54.632	-67.9	(-70.6, -65.2)	<0.000
Fiber	9.33	3.6 (2.9)	-6.992	-5.7	(-7.47, -3.92)	<0.000
Sugars	16.67	10 (3.1)	-8.22	-6.7	(-8.48, -4.95)	<0.000
Calcium	433.33	38.5 (44.9)	-31.732	-395	(-422, -368)	<0.000
Iron	6	1.1 (0.28)	-66.053	-4.9	(-5.06, -4.74)	<0.000
Potassium	1566.67	132 (37.6)	-137.679	-1435	(-1457, -1412)	<0.000
Sodium	766.67	129 (45.8)	-52.03	-637	(-664, -611)	<0.000
Total Saturated	6.67	3.8 (1.9)	-5.344	-2.81	(-3.96, -1.66)	<0.000
Cholesterol	100	0.07 (0.23)	-1499	-99.9	(-100, -99.8)	<0.000

Table 3. Comparison of 100% and 1/3 (33.3%) of Daily Values (DV)

	DV (Updated,2020)	1/3 of DV
Energy kcal	2000	666.67
Protein g	50	16.67
Total fat g	78	26
Carbohydrates g	275	91.67
Dietary Fiber g	28	9.33
Sugars g	50	16.67
Calcium mg	1300	433.33
Iron mg	18	6
Potassium mg	4700	1566.67
Sodium mg	2300	766.67
Total Saturated g	20	6.67
Cholesterol mg	300	100

Part 2. Survey

In this study, 259 college students' survey responses were collected in a 15-day period. 172 students completed the survey by answering 90% of the questions and 87 students were excluded from the study due to incomplete responses or a decline on the consent form. Demographics of the survey showed that 83% of participants were females and 67% of all participants were upperclassmen (junior or senior level).

The survey also showed that the majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently (Chart 2). This was a positive finding due to the nutritional analysis reports revealing that these breakfast bars contain as much saturated fat and carbohydrates as a Snickers bar.

It was revealed that 58% have replaced a breakfast bar for a meal but, only 16% have replaced a meal with a candy bar. The student responses also helped to determine that the healthiest bars, Fiber One Chewy Bar, Chocolate Peanut Butter and Clif Kid Z Bar, Peanut Brownie were those that contained the least amount of total lipid, saturated fat, and sugar (Chart 1).

Chart 1. From the table below, which one do you consider healthy?

Chart 2 How often do you consume nutrition bars (i.e. breakfast, lean, protein, fiber, energy)?
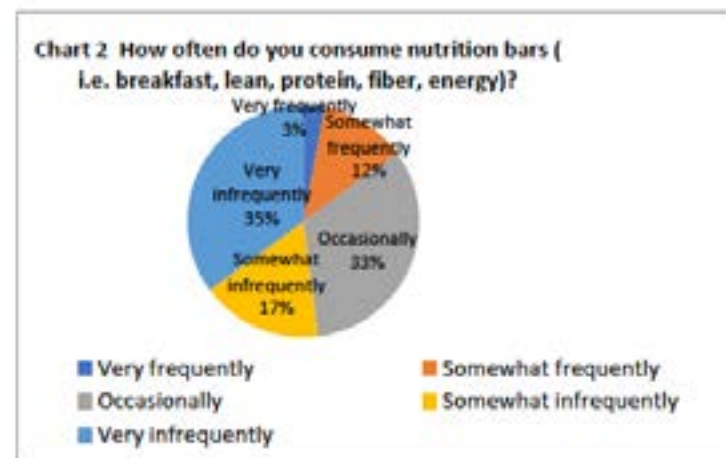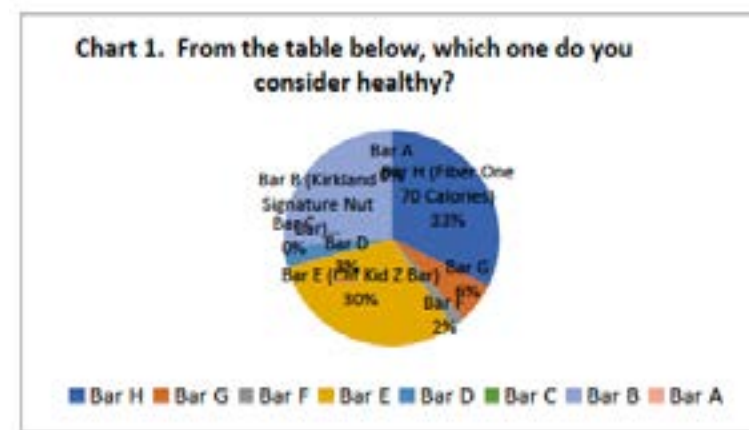
Conclusion

In using both the nutrition labels on the bars and the USDA FoodData Central database, it was revealed that Kind dark chocolate nuts & sea salt and Kirkland Signature nut bars have a greater total lipid content of than a Snickers bar; and Nature Valley bars have approximately the same total lipid content (> 1g difference). All bars except Nature's Path Organic Sunrise chunky chocolate peanut granola bar, contain more sodium (>52%) in a serving compared to the Snickers bar. In regard to protein content, the Snickers bar contains more protein than three bars and only less than a gram difference to six other bars.

Results also showed that the Snickers bar is not significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content. Therefore, we fail to reject the first null hypothesis of the nutritional analysis. The breakfast bars are significantly different in protein, fiber, iron, total sugar, sodium, energy and cholesterol when compared to the Snickers bar. We rejected the null hypothesis. Lastly, that none of the bars meet the nutrient's daily values for breakfast assuming that people are consuming 1/3 of their daily values. Therefore, we rejected the null hypothesis.

Results from the survey showed that the majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently. The survey also revealed that 58% have replaced a breakfast bar for a meal but, only 16% have replaced a meal with a candy bar. The student responses also helped to determine that the healthiest bars were based on containing the least amount of total lipid, saturated fat, and sugar. We rejected the null hypothesis that students would have no consensus as to what makes a breakfast bar healthy. From the nutritional comparison, the Snickers bar showed to not be significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content. Also, none of the bars met the nutrient's daily values for breakfast assuming that people are consuming 1/3 of their daily values. All goals and objectives for this study were met.

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The Breakfast Bar Study
Natali Mendez and Bonny Burns-Whitmore*

Background

Serving as one of the most innovative products in the food industry today, bar brands have successfully produced over 900 different bars that keep up with the consumers' demands. Popular for their convenient, ready-to-go nutrient and energy packed package, most bars also have a preserved health improvement and disease prevention component declared by nutrition claims, their labels and unique ingredients. These bars that can be classified into fiber bars, energy bars, diet bars (light), protein bars and breakfast bars. Breakfast bars act as a meal replacement, a weight loss product, or a snack between meals in many working people and students' daily lives. There is a concern that consumers consume breakfast or cereal bars, and do not know the nutritional value (Constantin, Istrati. 2018). If the purpose of consuming a breakfast bar is to serve a meal substitution, do people know that many breakfast bars can contain very close to the same amount of nutrients as the Snickers, which also contains peanuts/peanut butter and chocolate?

In this study, 40g of 14 commonly consumed breakfast bars, also referred to as cereal bars, that contain nuts and chocolate are compared to a candy bar that contains the same two ingredients, the Snickers bar. The Snickers bar is added in this study serving as the main comparison product which ultimately all bars will be compared to, revealing if there is a clear difference between two "opposite" bars.

Objectives

- The null hypotheses of the nutritional analysis are: (1) there will be no nutritional difference between the Snickers candy bar and the breakfast bars, (2) that people will be receiving 1/3 of their daily values (DV) in the breakfast bars.
- Research question is, "Is there a clear difference in nutrient composition between 40g of commonly consumed breakfast bars that contain nuts (peanuts/peanut butter) and chocolate, and a Snickers candy bar that also contains nuts (peanuts/peanut butter) and chocolate?"
- The null hypothesis for the survey is that students will have no consensus as to what makes a breakfast bar healthy.
- The purpose of the survey is to determine the frequency and nutrient details that control the consumption of breakfast bars, to learn college students' perspective as to what makes a product healthy, and which bar(s) is/are the healthiest.

Methods

- All 14 breakfast bars are commonly found at grocery stores, retail chains, gas stations, etc..
- The bars were normalized to 40g, the FDA's reference amount for grain-based bars to determine the comparison to the Daily Values.
- Nutritional data was obtained from the Food Data Central (formerly known as the USDA Nutrient Database) for the nutrient composition.
- One sample t-tests were used in SPSS version 27 to assess statistical significance using an alpha of 0.05.
- A RedJade survey (IRB# 20-215) link was sent to students in the College of Agriculture to assess their preferences of breakfast bars and how often they are consumed.

Results

Table 1 compares the mean of all 14 breakfast bars' nutrients to the Snickers' nutrient values and shows that there are no significance between all bars in total fat, carbohydrates, calcium, potassium, and total saturated.

Table 2 reveals that the Snickers bar does not contribute to the significance difference of the compared nutrients and that none of the breakfast bars including the Snickers bar meets the DV.

Results Continued

Chart 1. From the table below, which one do you consider healthy?
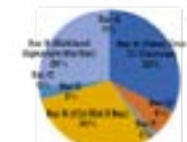
Chart 2. How often do you consume nutrition bars (i.e. breakfast, loss, protein, fiber, energy)?
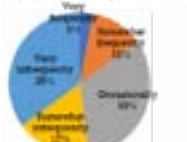
Concluding Remarks

- The Snickers bar is not significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content. Therefore, we fail to reject the first null hypothesis of the nutritional analysis.
- The breakfast bars are significantly different in protein, fiber, iron, total sugar, sodium, energy and cholesterol when compared to the Snickers bar. We rejected the null hypothesis.
- None of the bars meet the nutrient's daily values for breakfast assuming that people are consuming 1/3 of their daily values. Therefore, we rejected the null hypothesis.
- Students determined which bars were the healthiest based on the least amount of total lipid, saturated fat, and sugar. We reject the null hypothesis.
- The majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently.

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Constantin, O. E. and Istrati, D. I. (November 5th 2018). Functional Properties of Snack Bars, Functional Foods, Vasiliki Lagouri, IntechOpen, DOI: 10.5772/intechopen.81020. https://www.intechopen.com/books/functional-foods/functional-properties-of-snack-bars

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The Breakfast Bar Study

Natali Mendez, Dr. Bonny Burns-Whitmore

Natali Mendez

Project Abstract:

Curious about new products that are seen in our supermarkets promising health improvement and disease prevention components determined by their ingredients, I chose to do my project on breakfast bars. The research question is, "Is there a clear difference in nutrient composition between 100g of commonly consumed breakfast bars that contain nuts (peanuts/peanut butter) and chocolate, and a Snickers candy bar that also contains nuts (peanuts/peanut butter) and chocolate?" My hypothesis is that there will be no nutritional difference between the Snickers bar and the breakfast bars. Consumption is influenced by the nutrition labels, therefore by analyzing and comparing, using SPSS and the USDA database, I will reveal if having a candy bar for breakfast delivers the same energy and nutrients as a breakfast bar. Another key part of my study is to find out the frequency and nutrient details that determine consumption of breakfast bars to ultimately, aid them in selecting healthier choices of foods.

Background or Motivation

- Consumers are unaware that many breakfast bars do not contain the assumed amount of protein, fiber, or essential nutrients, nor that they contain more added sugars than the daily value requirement.
  - A breakfast bar and a Snickers bar can be more similar in nutrients than we think. Thus, perhaps breakfast bars may be inadequate to serve as a breakfast replacement.
- I hope to bring awareness by enhancing the nutritional knowledge of consumers on breakfast bars.
  - Consumers will benefit from knowing the comparisons between numerous common breakfast bars and what a breakfast bar will deliver in terms of nutrients.
  - I wanted to compare these breakfast bars and a chocolate bar, like a Snickers bar, to see if they are or are not significantly different.

Techniques and Methods

Chart 1. From the table below, which one do you consider healthy?

Chart 1 reveals that the perceived healthiest bars among eight options were bar H (Fiber One Chewy Bar, Chocolate Peanut Butter) and Bar E (Clif Kid Z Bar, Peanut Brownie). These two bars contained the least amount of total lipid, saturated fat, and sugar.

Legend: Bar H, Bar G, Bar F, Bar E, Bar D, Bar C, Bar B, Bar A

Chart 2. How often do you consume nutrition bars (i.e. breakfast, lean, protein, fiber, energy)?
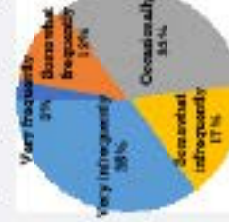
Pie chart 2 shows that the majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently.

Legend: Very frequently, Occasionally, Very infrequently, Somewhat frequently, Somewhat infrequently

Table 1. A one sample t-test compared the mean of all 14 breakfast bars' nutrients to the Snickers' nutrient values and shown that there are no significant differences between all bars in total fat, carbohydrates, calcium, potassium, and total saturated fat.

Table 2. A one sample t-test demonstrates that the Snickers bar does not contribute to the significance difference of the compared nutrients and that some of the breakfast bars including the Snickers bar meets the Daily Values for a breakfast assuming that the person is consuming 1/3 of their Daily Values for the day for breakfast.

Results and Conclusions

- Results
- The Snickers bar is not significantly different from the mean of the 14 breakfast bars in total fat, carbohydrates, calcium, potassium, and total saturated fat content.
  - The breakfast bars are significantly different in protein, fiber, iron, total sugar, sodium, energy and cholesterol when compared to the Snickers bar.
- Breakfast bars do not meet the nutrient Daily Value requirements.
- Conclusions
- Breakfast bars should not be replaced for a breakfast meal-they do not meet the 1/3 Daily Value requirement
- The null hypothesis that both breakfast bars and Snickers bars are the same, was rejected in favor of the alternate hypothesis that breakfast bars and Snickers are both different and similar as evidenced in Table 1 and 3.
- The survey revealed that the majority of students (35%) consume breakfast bars 'very infrequently' versus only 15% consuming them 'very' to 'somewhat' frequently.
- Students perceived the healthiest bar based on which one contained the least total lipid, saturated fat, and sugar.

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Mendez Omar*   **Community-Cultural Wealth among First-generation BIPOC English Language Learners in Higher Education.**

Abstract

According to the U.S. Department of Education, English Language Learners (ELLs) are becoming an increasingly essential part of the K–12 school population. In the United States, one out of every five children now live in a family where a language other than, or in addition to English, is spoken. Although research has been conducted on how ELLs and linguistic minorities confront structural challenges and disadvantages, there have been limited studies that examine how they overcome these barriers. In particular, there is a paucity of research on the experiences of ELLs who identify as Black, Indigenous, and People of Color (BIPOC), as well as those who are first-generation college students. As such, the present pilot study qualitatively explored the academic experiences of first-generation ELL college students who self-identify as BIPOC. Moreover, this study examined the students' experiences through a Critical Race Theory (CRT) grounded strength-based approach. Specifically, the Community Cultural Wealth (CCW) model was selected to examine the lived experiences of these students as they navigate structural challenges in their college education through their aspirational, linguistic, familial, social, navigational, and resistant capitals. Research that is grounded on CRT and is strength-based is keenly needed for understanding, elevating, and supporting the success of these students in higher education. Preliminary findings from the five completed interviews suggested that the participants are utilizing their strengths, talents, and experiences (i.e., their capital) as students of color in higher education institutions. The importance of peer relationships, campus/community organizations, familial values, and social justice were among the emergent themes that were prominent. Limitations of the study include the lack of diversity in terms of participant's gender identity, with all of them identifying as female. Another factor was that most participants attended a Hispanic Serving Institution. Implications of the study will be further discussed in this presentation.

Major Objectives

The Community-Cultural Wealth model will be used to examine how participants navigate structural challenges based on their aspirational, linguistic, familial, social, navigational, and resistant capitals.

Background research with analysis and summary of literature review

According to U.S. Department of Education, English Language Learners (ELLs) are becoming an increasingly essential part of the K–12 school population. In the United States, one out of every five children now live in a family where a language other than, or in addition to English, is spoken (Bergey et al., 2018). During the 2014-15 school year, over 4,800,000 ELLs, approximately 10% of the overall K-12 school population, were enrolled in schools in the U.S. Further, when examining race/ethnicity, Latinx students comprised more than 75%

of ELLs, although as a collective, they represented only 25% of all students. Similarly, Asian students comprised a higher percentage of ELLs relative to their percentage in the student body; roughly 5% of all Asian students comprised 11% of ELLs. Moreover, in the 2016-17 school year, White ELLs were the third largest race/ethnicity category of ELLs in U.S. public schools, comprising 6.3%. Lastly, Black students were the fourth largest group of ELLs, accounting for 3.9% of the student population (U.S. Department of Education, 2016).

With the growing number of BIPOC ELLs in U.S. schools, it is essential to mention that they are also a demographic that is growing in higher education. First-generation ELLs are increasingly enrolling in higher education institutions. Children born in the United States to immigrant parents represent approximately about 20% of all college students in the United States and 24% of all community college students (Community College Consortium for Immigrant Education, 2015). Although more first-generation BIPOC students are enrolling in higher education, most ELLs encounter significant barriers getting into college. According to previous research, ELLs face structural barriers to postsecondary access as a result of their status as ELLs (Callahan, 2005; Callahan & Shifrer, 2016; Callahan, Wilkinson, & Muller, 2010; Kanno & Kangas, 2014; Umansky, 2016). Furthermore, according to the findings of a previous study on what is preventing high-achieving ELLs from enrolling in a four-year institution, ELLs' access to higher education is being restricted due to advanced placement course limitations. Since of their English language status, ELLs are frequently discouraged from taking these courses by their teachers and administrators, as well as their limited knowledge regarding college and language proficiency (Kanno, 2018). These barriers are reflective of the disparity present in ELL and non-ELL college graduation rates. Approximately 85% non-ELL students complete their college degrees, whereas only 66% of the ELL population complete their college degrees on time (National Center for Education Statistics, 2018). Further, in examining the reasons for this discrepancy, studies demonstrate that ELL students are often directed to less challenging courses (Nguyen, 2020); are subjected to additional course requirements; are placed in sheltered educational settings (i.e., instead of mixing both, ELLs are isolated from English-speaking classmates), and are tested more frequently (Callahan et al., 2010; Clark-Gareca et al., 2020; Menken & Kleyn, 2010). Despite the fact that additional course requirements such as English fluency courses were designed to support ELL students, current trends indicate that ELLs have less access to becoming college ready. These students are devoting less time to college-approved coursework and fewer hours to non-ELL courses (Clark-Gareca et al., 2020; Hakuta et al., 2000). In addition, ELL programs also fall short of meeting student needs to prepare them for college (Nguyen, 2020). It is also important to highlight that while developing ELL programs, Supreme Court rulings did not consider "college-readiness" as part of a right to a high-quality education (Nguyen, 2020). Overall, ELLs are often discouraged from pursuing college-pathways due to their classification as ELLs and their lack of expertise in the English language (Nguyen, 2020).

Nonetheless, previous studies have examined how secondary schools operationalize readiness to help ELL students access to higher education (Nguyen, 2020). Research documenting ELLs experiences in higher education have been limited in the last decade (Bunch, 2008; Kanno & Cromley, 2012; Nuez & Sparks, 2012). A study conducted by Oropeza and colleagues (2010) examined how four linguistic minority students accessed and navigated college by drawing on their community's cultural wealth and various forms of capital. Specifically, through the lens of Critical Race Theory, this study utilized the Community's Cultural Wealth (CCW) model. The CCW model is a strength-based approach for understanding how students of color access and navigate college through six different capitals, including aspirational, linguistic, familial, social, navigational, and resistant. The first dimension, aspirational capital, refers to the ability to keep one's ambitions and dreams for the future alive despite real or apparent obstacles. Next, linguistic capital incorporates the intellectual and social skills gained from communicating in more than one language and/or style. Third, familial capital pertains to cultural knowledge and ideas passed down through the generations that carries a feeling of collective history, memory, and cultural intuition. Fourth, social capital, encompasses a collection of social networks and community resources. Fifth, navigational capital refers to the ability to navigate through social institutions, specifically those that were not historically designed with communities of color in mind. Lastly, resistant capital refers to the knowledge and abilities gained from challenging inequality (Yosso, 2006). Research by Oropeza and colleagues (2010) focused on these six capitals to demonstrate how four female students from Russia, China, Iran, and Somalia/Kenya navigated college. Results from the study revealed that labels and classifications have an impact on not just how students are perceived, but also the specific services that are made available to them (Oropeza et al., 2010). For example, linguistic minority students' identities allowed them to cultivate many forms of capital such as aspirational, linguistic, familial, social, navigational, and resistant (Oropeza et al., 2010). For instance, although students' identities/labels created challenges through their negative associations, these students were able to build capital and addressed them constructively by utilizing their strengths (Oropeza et al., 2010). As a result, most students in the study accepted their labels and only few entirely rejected them.

Although Oropeza and colleagues (2010), highlighted the necessity of utilizing the CCW framework, there has been little research that used this approach to examine the experiences of first-generation BIPOC ELLs. The CCW model is a powerful strength-based method that can benefit first-generation BIPOC ELLs by accounting for the skills, abilities, and experiences that students of color bring with them to their college experience (Yosso, 2006).

In sum, there is a significant gap in research that examines the experiences, educational access, and navigational skills of ELLs a higher education context. Specifically, there is a distinct lack of research that utilizes a strength-based framework to understand the various strategies used by first-generation ELLs to navigate and overcome structural challenges encountered in higher education. The purpose of this study is to address these research gaps by qualitatively examining the experiences of ELL students in higher education, with a special emphasis on first-generation BIPOC students. The CCW model will be applied to examine how participants navigate structural challenges through their aspirational, linguistic, familial, social, navigational, and resistant capitals.

Methods

Participants: This project will serve a pilot study to explore the academic experiences encountered by this unique population of students. Due to pilot nature of this study, approximately five participants are intended to be recruited. Participants will consist of currently matriculated first-generation college students who self-identify as BIPOC and who have previously received ELL services prior to attending college.

Materials: This study will require access to relevant literature and databases, which are all available to the researcher through the library at California State Polytechnic University, Pomona. In addition, to conduct interviews, an audio recording service, and a telephone will be required.

Measures: A demographic questionnaire will be designed for this study to acquire further information about the participants. Race, age, socioeconomic status, university level, and parent/caregiver education levels, among other things, will be included in the demographic questionnaire (see Appendix A for the complete list of questions). Participants will also take part in a semi-structured interview (see Appendix B). The interview questions will center on how the participants overcame structural barriers in higher education.

Procedures: This study will be approved by the Institutional Review Board at California State Polytechnic University, Pomona, prior to data collection. Data collection will commence once the study has been approved. At this time, participants will be contacted, and a consent form (see Appendix C) will be emailed to them. Recruitment will be conducted via social media (See Appendix D), emails (see Appendix E), and higher education coordinators who are dedicated to the success of BIPOC students (see Appendix F).

Ethical Considerations

Prior to the start of the interviews, all participants' informed consent will be obtained (see Appendix C). In addition, all interview information is protected, and no participant responses will be linked to any personally identifiable information.

Please describe progress made this period towards your project's stated goals and objectives: (This section is a summary of what you have found out in your experiment so far. Your data/result and discussion should be included here)

Preliminary findings from all five completed interviews suggested that the participants are utilizing their strengths, talents, and experiences (i.e., their capital) as students of color in higher education institutions. The importance of peer relationships, campus/community organizations, familial values, and social justice were among the emergent themes that were prominent. For example, when it came to the theme of peer relationships, all the participants mentioned how important it was to have a connection and bond with other students. As a first-generation college student, one participant found it beneficial to have other students assist her with scholarships, financial aid, and other matters. The participants also valued having peers with similar experiences to assist them with navigating higher

education. For the campus/community organization theme, all participants were all actively involved in campus and community organizations. Bright Prospect, Gente Organizada, and EOP were among the organizations mentioned. Participants discussed how their involvement in organizations aided them in succeeding in higher education. One participant, for example, enjoyed how EOP brought her not just to friendships but also to a variety of resources such as tutoring. Furthermore, regarding the familial values theme, all the participants discussed how their parents' backgrounds influenced their ability to achieve and navigate higher education. The participants' parents were all immigrants, as they were first-generation students. Participants admired their values because of their parents' immigration status and influence. One value shared by a participant from their family/parents was that their parents always emphasized the necessity of perseverance and the value of education. Lastly, perhaps most intriguingly, I uncovered the theme of social justice. In some way, all the participants highlighted the importance of social justice. They all stressed the need of speaking up for those who cannot. The participants were also educated on a variety of social justice issues, including prejudice and racism, as well as how to combat or raise awareness concerning them. As a result, the participants used their social justice knowledge to navigate higher education in advocating for themselves and others. Overall, the next steps are to begin the coding and analysis process in the Fall semester, with the goal of publication.

Discussion

As previously said, the preliminary findings indicate that first-generation BIPOC English Language Learners are navigating and succeeding in higher education using their capitals. It is clear from this research that despite the numerous obstacles and barriers that these students experience, they are persistent and continue to pursue onward. In addition, new and essential information for future research investigations and colleges was shown. For example, this study found that aspirational, linguistic, familial, social, navigational, and resistance capitals all have an impact on BIPOC ELLs' experiences and achievement. Overall, this study provided a better understanding of how BIPOC ELLs navigate higher education. This is relevant considering the paucity of research into ELLs experiences. The study had some limitations, such as the fact that it is a pilot study with only five participants. Participants have had to be enrolled in a four-year university as well. Furthermore, there was a lack of diversity in terms of gender identity among participants, with all of participants identifying as female. Finally, the majority of the participants went to a Hispanic Serving Institution. In conclusion, future research should focus on the experiences of first-generation BIPOC ELLs at both Hispanic Serving Institutions and predominantly white institutions. Future studies could also delve into the experiences of all gender identities.

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Stop Being So Negative: Reports Correcting False Claims are Distrusted More than Reports Confirming Claims

Abstract

Two studies support the hypothesis that people distrust reports that correct false claims more than reports that confirm claims as true. In Study 1 participants read real fact checks that corrected or confirmed plausible claims relevant to politics or economics. In Study 2 participants read real reports that correct or confirm plausible marketing claims. Participants in both studies reported more distrust (i.e., thinking reporters are dishonest and have ulterior motives) for corrective reports. This affect held across political ideology groups. Mechanisms include more surprise and a higher standard of evidence for corrections, but the effect holds even among corrections consistent with respondents' prior beliefs, suggestive of an inherent negativity of attempts to correct beliefs. We propose that this effect is a fundamental feature of how people consume (mis)information.

Introduction

Here we propose a general property of information consumption: people are generally trusting of reports that confirm claims (e.g., a fact check with a "true" verdict), but are relatively more distrusting towards (i.e., having doubts about the honesty of) reports that correct claims (i.e. a fact check with a "false" verdict). Classic work in social science highlights asymmetries in how people think about positive and negative things. People pay more attention to negative things as opposed to positive things and tend to understand the world through forming positive hypotheses (Peeters, 1971). Negative words are understood through positive words, often existing as negative prefixes attached to positive terms (Matlin & Stang, 1978). Correspondingly, people have a belief bias, tending to automatically believe unfamiliar propositions (Gilbert, 1991). Additionally, Levinson (2006) argues that humans have an "interaction engine" that gears people towards broadly being cooperative, building on Grice's (1975) classic linguistic cooperation principle. Levinson proposes that humans have a set of innate mechanisms geared towards producing smooth social interactions, one of which is a tendency towards cooperative interactions. Levinson notes he means this not in the sense that people feel it necessary to get along with everyone else, but that people are inclined towards producing interpretable actions and contributing to some joint undertaking, such as having a conversation. Given negativity and belief biases, attempts to disprove claims are perhaps seen as negative and undermining to smooth interactions, and could engender more suspicion that the reports are not honest, even for claims people are not invested in.As work on reactions to fact checks has proliferated (Walter et al., 2020), some research has been suggestive of such an asymmetry, such as work showing that when evaluating claims from a single politicians belief change only changes when corrections outnumber confirmation (Aird et al., 2018) or that corrections cause more counterarguments than confrimations (Lewandosky et al., 2005; Taber & Lodge, 2006). However, the asymmetries in these papers are explained in terms of motivation to support pre-existing beliefs, rather than a generalized distrust of corrections compared to corrections.

In sum, the literature suggests not only that people are more distrusting of corrections than confirmations, but also suggests two underlying mechanisms. One is a higher barrier to belief for corrections, owing to people's tendencies to be inclined towards belief and positive claims. The other is an increased sense of surprise for corrections, also since corrections will contradict tendencies towards belief but also because corrections are more undermining to smooth interactions. A strong version of this idea is that these mechanisms are just partial. In other words, even if corrections are completely expected and believable, if they are inherently negative people might still be distrusting of them compared to confirmations. To test the generalizability of our hypothesis, we test it using a range of topics that include issues that are not currently controversial and unlikely to have much prior investment, and we test it in and out of contexts explicitly labeled as "fact checks".

Methods

The two studies reported here use quite different contests to test the hypothesis that people distrust authors of corrections more than authors of confirmations. Both involve an initial rating of a claim, exposure to a report confirming or correcting the claim, and then re-rating belief in the claim as well as distrust of the reporter. The main analysis comparing distrust for confirmatory and correcting reports was pregistered for both studies (Study 1: https://aspredicted.org/ZTM_DW9, Study 2: https://aspredicted.org/YVF_G42).

Study 1

Participants. A gender-balanced sample was recruited from Prolific Academic (N = 690). This sample size was as chosen to allow more than 95% power to detect a small effect in a t-test and allow at least 80 participants to be assigned each claim. Both studies include an oversample of 100 self-identified ideological Conservatives, who otherwise would be under-sampled (Clifford et al., 2015).

Procedure

Initial headline evaluation. Participants were first told were interested in how people consume media about current events and were asked to read a series of political or economic claims (randomly ordered) and rate how likely each claim was to be true on a 9-point scale (1 = Very unlikely to be true, 9 = Very likely to be true). The claims used are displayed in Table 1. See Supplemental Materials Section 1 for full list of instructions and text of all measures used.

Table 1.
Claims used in Study 1 (short name used in Table 3 is in parenthesis)

False claims (used in Correction condition)	*True claims (used in Confirmation condition)*
Homelessness in Los Angeles rose 50% between 2013 and 2018. (Homelessness)	40 percent of food in the US never gets eaten. (Food)
The U.S. imports 90% of its aluminum. (Aluminum)	In 2019, 61% of overdose deaths in Delaware involved Fentanyl. (Fentanyl)
In 2017, 23 million Americans said they were opposed to repealing net neutrality rules. (Net neutrality)	Young people made up only 13% of the vote in 2014. (Young vote)
Congressional salaries have gone up 231% in the past 30 years. (Congress pay)	30 percent of federal workers are veterans. (Veterans)

Fact check. After rating perceived truthfulness of all eight headlines, participants were presented with a fact check of one of the headlines selected at random, see Supplemental Materials section 1.2 for instructions and https://osf.io/vqg8n/?view_only=2b3fa992bb1c4f38b44061ea47227c06 to view the stimuli. These were actual fact checks taken from checkyourfact.com. CheckYourFact is a verified signatory of the International Fact Check Network code of principles (IFCN, 2021). We chose it due its relatively non-confrontational but informative presentation style that lists the claim at the top of the report and explains where it comes from, lists whether the claim is true or false, and then displays the corresponding evidence. Half of the fact checks were verifications (i.e., explaining why the claim was true), the other half were corrections (i.e., explaining why the claims were false).

Reactions to fact check. After viewing the fact check, participants completed several measures. They first re-rated how likely the news headline is to be true on the same 9-point scale as before. Participants were then asked to rate their agreement with a series of statements regarding the motives and credibility of the fact-checker on a 9-point scale (1=Strongly disagree to 9=Strongly agree).

Four items comprised the main dependent variable measuring distrust in the fact checker, all tapping some element of thinking the fact checker is not being fully honest. Two other items are used as mediators. One item addressed the need for more information to believe the fact check (i.e. to capture if corrections have a higher barrier to evidence) and one item measured surprise at the result of the fact check. See Supplemental Materials Section 1.2 for all item text, including some items included for exploratory purposes.

At the end of the survey some basic demographic information is collected from participants, including age, and political ideology. Ideology was measured both categorically (choices were Liberal, Conservative, Libertarian, Other, and None), and continuously via two questions regarding economic and social ideology (Pennycook & Rand, 2019).

Results

Summary statistics for initial belief, belief after "fact check", and the 4-item index of distrust in the fact checker (α = .86) are in Table 2, including results of t-tests by condition. Initial belief by issue is included in Table 3.

Table 2.
Main analysis variables in Study 1, overall and by condition.

| | Total | | Report type condition | | | | | | |
| | | | Correction | | Confirmation | | Mean difference (Correction – Confirmation) | t | p |
	M	SD	M	SD	M	SD			
Distrust in reporter (DV)	3.38	1.96	3.89	2.00	2.86	1.78	1.03	7.16	<.001
Initial belief in target claim	6.34	1.96	6.36	2.02	6.31	1.90	0.05	0.33	0.74
Belief in claim after report	5.38	3.15	2.92	2.37	7.91	1.50	-4.99	-33.86	<.001
Change in belief in claim	-0.97	3.53	-3.45	2.79	1.58	2.09	-5.04	-26.59	<.001
Need more info to know if report is true (mediator)	4.58	3.60	5.18	2.56	3.97	2.50	1.22	6.33	<.001
Report was surprising (mediator)	3.91	3.51	4.66	2.39	3.16	2.42	1.49	8.16	<.001

Note: "Correction" condition = respondent saw a fact check that declared a claim false, "Confirmation" condition = respondent saw a fact check that declared a claim true. Respondents rated belief for all claims in the first part of the study and saw a fact check for one randomly selected target claim in the second part of the study, "target claim" in this table refers to the claim the respondent saw fact checked. All constructs here measured via 9-point scales.

Table 3.
Main analysis variables in Study 1, by claim.

| | Distrust in Fact Checker (DV) | | Initial Belief in Claim | | Belief in claim after report | | Change in belief in claim | | Need more info to know if report is true (mediator) | | Report was surprising (mediator) | |
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
False claims (used in Correction condition)												
Homelessness	3.99	1.97	6.82	2.04	3.44	2.51	-3.45	2.73	5.13	2.52	4.63	2.36
Aluminum	3.70	1.97	5.83	1.85	3.33	1.95	-3.53	2.87	4.48	2.51	4.51	2.38
Net neutrality	3.56	1.96	5.64	1.94	3.09	2.24	-2.52	2.73	5.34	2.43	4.53	2.11
Congress Pay	3.93	2.13	7.16	1.85	3.30	2.23	-4.32	2.59	5.38	2.64	4.95	2.66
True claims (used in Confirmation condition)												
Food	2.52	1.75	6.45	1.98	7.85	1.63	1.35	2.17	3.42	2.21	3.19	2.56
Fentanyl	2.56	1.75	6.83	1.71	7.95	1.63	1.87	1.75	3.71	2.55	2.89	2.31
Young vote	3.15	1.66	6.29	1.82	7.73	1.45	1.44	1.97	4.56	2.34	3.15	2.22
Veterans	3.31	1.97	5.67	1.91	8.10	1.27	2.46	2.21	4.30	2.76	3.60	2.61

Note: Respondents initially rated all claims, so the sample for "initial beliefs" is the full study sample, other variables are limited to respondents assigned to see a fact check for that claim.

Initial belief. Table 2 shows that initial claim belief ranged from 5.67 to 7.16, so respondents generally saw the claims as plausible. Table 1 also shows that there was no significant difference between initial beliefs in target claims for the confirmation and correction conditions (see second row), so levels of belief in the target claim were similar for both conditions.

Main analysis. A between-subjects t-test revealed that fact checkers who correct a claim (M = 3.89, SD = 2.00) were distrusted more than fact checkers that confirm a claim (M = 2.86, SD = 1.78), mean difference = 1.03 [.75, 1.31], t = 7.16, p < .001 Hedges's g = -.54, see Figure 1. A follow-up ANOVA that also controlled for initial belief in the target claim and political ideology still revealed an effect of fact check type, F(1, 686) = 45.92, p < .001, partial η2 = .06.
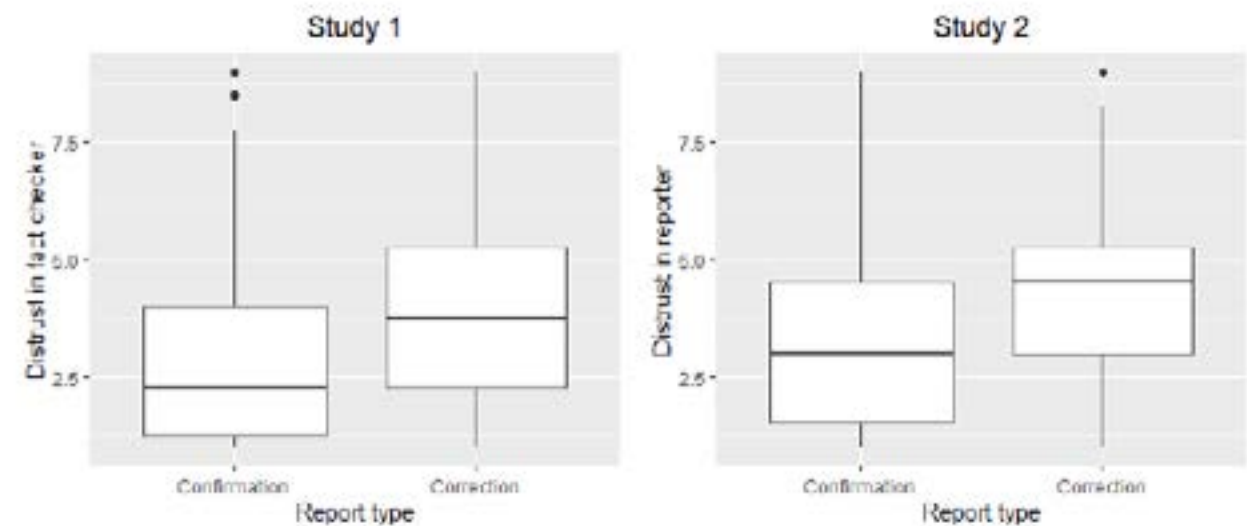
Fig. 1. Main effects of report type (confirmation vs. correction) on distrust of fact checker (Study 1) or reporter (Study 2).

An analysis by political ideology for Study 1 and Study 2 is in Supplemental Materials Section 3. Across both studies, we observed main effects such that Conservatives compared to Liberals are more distrusting of reports in general (i.e. both corrective and confirmatory), but also importantly the main effect of report type robustly holds within each ideology, including Conservatives, Liberals, and unaffiliated.

Mediation and "surprise" analysis. We conducted a mediation analysis using PROCESS (Hayes, 2017). Condition (confirming vs. correcting) was the independent variable, distrust in the fact checker was the dependent variable, and the questions on whether the respondent needed more information to judge the fact check and whether the respondent was surprised by the outcome of the fact check were parallel mediators. Full results of this mediation analysis are in Table 4.

Table 4.
Mediation analysis in Study 1 and Study 2.

	Study 1			Study 2		
	Coeff	*t*	*p*	*Coeff*	*t*	*p*
Mediator 1 - Surprise						
Constant	1.67 [1.11, 3.35]	5.79	< .001	7.37 [6.84, 7.89]	27.60	< .001
Condition (IV)	1.48 [1.13, 1.84]	8.12	< .001	2.23 [1.90, 2.56]	13.19	< .001
Mediator 2 – Need more info						
Constant	2.75 [2.15, 3.34]	8.99	< .001	7.60 [7.00, 8.20]	24.81	< .001
Condition (IV)	1.22 [.85, 1.60]	6.32	< .001	1.29 [.89, 1.65]	6.54	< .001
Dependent Variable – Distrust of fact checker (Study 1)/reporter (Study 2)						
Constant	.58 [.19, .98]	2.91	.004	2.09 [1.45, 2.57]	7.06	< .001
Condition (IV)	.38 [.14, .63]	3.07	.002	.39 [.14, .64]	3.11	.002
Surprise	.13 [.08, .19]	5.07	< .001	.13 [.08, .18]	4.89	< .001
Need more info	.37 [.32, .42]	14.97	< .001	.30 [.25, .34]	13.02	< .001
Direct & Indirect Effects						
	Coeff	*SE*		*Coeff*	*SE*	
Direct effect	.38 [.14, .63]	.12		.39 [.13, .64]	.13	
Surprise (indirect effect)	.20 [.10, .31]	.06		.28 [.14, .44]	.07	
Need more info (indirect effect)	.46 [.30, .62]	.08		.37 [.26, .50]	.06	

Note: Condition = report type (correction vs. confirmation).

Indirect effects were revealed for both the "more information needed" question, B = .20, [.10, .32], and "surprise" question, B = .45 [.30, .61]. There was still a direct effect of condition, B = .38 [.14, .63], leaving open the possibility of a direct link between corrections and negativity.

We also indirectly looked at the effect of "surprise", inferring whether the fact check was surprising relative to their initial belief. Full results of this analysis are in Supplemental Materials Section 4. Most importantly for the present purposes, this analysis found that even the fact check was consistent with participants' prior beliefs (i.e., they correctly guessed the outcome of the fact check or were initially neutral), it was still the case that fact checkers are distrusted more when correcting, rather than confirming a claim.

Impact on belief change. We subtracted the post-fact check rating of belief in the central claim from the initial rating to form an index of belief change and examined how distrust affected belief change. Greater distrust in the correction condition is associated with less belief change. A regression analysis found that condition and distrust interact to predict belief change, B = .68 [.49, .87], *p* < .001, such that distrust has a larger effect in the correcting condition, B = .51 [.39, .64], *p* < .001, than in the confirming condition, B = -.16 [.39, .64], *p* = .02. This interaction is plotted in Figure 2, which illustrates that in the correction condition in particular distrusting the fact checker is associated with less belief change.
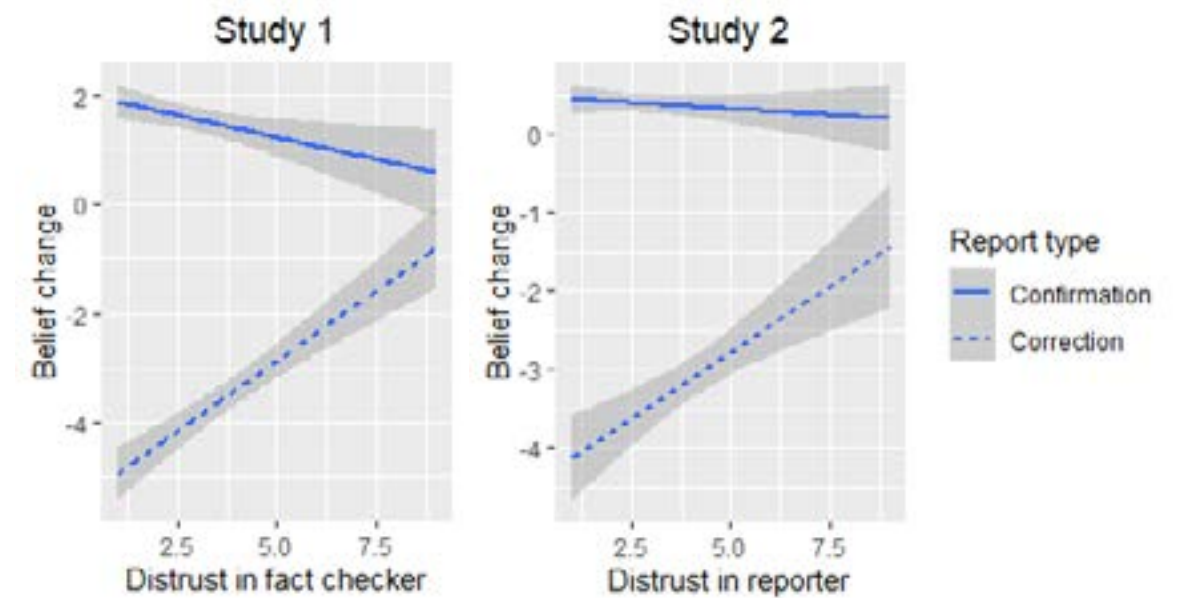
Fig. 2. Relationship between distrust in fact checker/reporter and belief change in central claim for Study 1 (left) and Study 2 (right). On the y-axis, positive values indicate the respondent is more certain the claim is true, negative values indicate the respondent is more certain the claim is false, and 0 indicates no change.

Study 2

Participants. 691 participants completed the study on Prolific Academic, using the same attention checks as in Study 1.

Procedure. Participants in this study were randomly assigned to read a marketing claim from a brand. These claims came from one of three scenarios, see Table 5 Text for each claim was taken from official materials for each brand. After reading this initial information, participants were asked how familiar they were with the brand prior to reading and completed a two-item measure of initial belief in the claim and a three-item measure of perceived value of the product. All items were measured on 1-9 agreement scales. Full text of the items, instructions, and materials used for each scenario are in Supplemental Materials Section 2. So, unlike Study 1, participants saw only one claim (for which they were also given an explanation) in this stage rather than rating a sequence of claims.

Next, participants read a report that either confirmed or corrected the claims. These reports were all excerpted from real journalistic reports written about the claims. However, the journalistic outlet was not named. Since we used only real stimuli and stories, the actual target product/brand differs between conditions, although the target claims are similar.

Table 5.
Brands/products and the claims used in Study 2.

Scenario	Target product/brand, Correction condition	Target claim, Correction condition	Target product/brand, Confirmation condition	Target claim, Confirmation condition
"Humane" animal products	Sparboe Farms eggs	Sparboe Farms treat their chickens humanely.	La Quercia pork meat products	La Quercia meat treat their pigs humanely.
Cooking "hack" videos	5-Mintute Recipes: Short YouTube cooking videos.	Easy unconventional cooking hacks with surprisingly good end-results.	Chowhound: Cooking hack article.	Cooking tips meant to make cooking easier and more efficient.
Pop-punk bands	Tramp Stamps	Tramp Stamps formed organically when they met at a bar.	Doll Skin	Doll Skin formed when members competed in and won

				high school music contest.

After reading this report, participants re-rated their belief in the claim and perceived value of the product. Participants then completed the same "Reactions to fact check" dependent measures and mediators measure as in Study 1 (swapping out the text "author of the fact-check" for "author of the article presented on this page").

As in Study 1, participants ended the survey with demographic measures including political ideology.

Results

Summary statistics for belief in the claim and evaluation of the product, both before and after the corrective/confirming report, and the 4-item index of distrust in the fact checker (α = .86) are in Table 6, both for the total study and by scenario.

Table 6.
Main analysis variables for Study 2, for across scenarios and in total.

| | Total | | Report type condition | | | | Mean difference (Correction - Confirmation) | t | p |
| | | | Correction | | Confirmation | | | | |
	M	SD	M	SD	M	SD			
Total									
Distrust in reporter (DV)	3.62	1.78	4.15	1.72	3.09	1.69	1.06	8.13	<.001
Initial Belief in Claim	6.86	1.73	6.69	1.82	7.02	1.61	-0.33	-2.51	0.01
Belief in claim after report	5.51	2.64	3.62	2.08	7.40	1.57	-3.78	-27.04	<.001
Change in belief in claim	-1.35	2.61	-3.06	2.54	.38	1.10	-3.44	-23.13	<.001
Need more info to know if report is true (mediator)	5.70	2.62	6.33	2.42	5.06	2.66	1.27	6.54	<.001
Report was surprising (mediator)	4.02	2.48	5.14	2.42	2.90	1.99	2.24	13.27	<.001
Humane product scenario only									
Distrust in reporter (DV)	3.63	1.86	3.93	1.91	3.34	1.77	0.59	2.42	0.02
Initial Belief in Claim	7.29	1.73	7.58	1.66	6.99	1.75	0.59	2.67	0.01
Belief in claim after report	5.04	2.93	2.71	1.84	7.39	1.68	-4.68	-20.09	<.001
Change in belief in claim	-2.23	3.32	-4.84	2.58	.41	1.25	-5.25	-19.55	<.001

Need more info to know if report is true (mediator)	5.84	2.56	6.45	2.41	5.21	2.57	1.24	3.76	<.001
Report was surprising (mediator)	4.54	2.68	5.97	2.45	3.09	2.05	2.88	9.67	<.001
Cooking hack scenario only									
Distrust in reporter	3.64	1.82	4.40	1.70	2.88	1.62	1.52	6.92	<.001
Initial Belief in Claim	6.48	1.67	6.16	1.62	6.80	1.66	-0.64	-2.97	0.00
Belief in claim after report	5.43	2.52	3.64	1.95	7.22	1.60	-3.58	-15.17	<.001
Change in belief in claim	-1.04	2.08	-2.51	1.88	.44	.88	-2.95	-15.22	<.001
Need more info to know if report is true (mediator)	5.25	2.60	6.10	2.37	4.39	2.55	1.71	5.22	<.001
Report was surprising (mediator)	3.69	2.37	4.61	2.43	2.77	1.91	1.84	6.37	<.001
Pop-punk band scenario only									
Distrust in reporter (DV)	3.59	1.66	4.11	1.50	3.07	1.65	1.04	5.09	<.001
Initial Belief in Claim	6.80	1.70	6.33	1.84	7.27	1.40	-0.94	-4.42	<.001
Belief in claim after report	6.04	2.35	4.48	2.06	7.59	1.41	-3.11	-13.50	<.001
Change in belief in claim	-.78	1.97	-1.85	2.06	.28	1.13	-2.13	-9.83	<.001
Need more info to know if report is true (mediator)	6.00	2.65	6.44	2.49	5.57	2.75	0.87	2.53	0.01
Report was surprising (mediator)	3.84	2.32	4.83	2.17	2.85	2.02	1.98	7.23	<.001

Note: "Correction" condition = respondent saw a fact check that declared a claim false, "Confirmation" condition = respondent saw a fact check that declared a claim true.

Initial belief. In both conditions in all scenarios participants considered the claims plausible on average, with initial belief averaging between 6.16 and 7.58. On average across claims respondents found the true claims more plausible (second row). However, in the humane product scenario this reversed with respondents finding the false claim more plausible on average, so our hypothesis is tested in situations in which both the true and false claims seem more plausible.

Main analysis. Replicating Study 1, reporters correcting a claim (*M* = 4.14, *SD* = 2.37) were distrusted more than reporters confirming a claim (*M* = 3.09, *SD* = 1.69), mean difference = 1.05 [.80, 1.31], t = 8.12, *p* < .001 Hedges's *g* = .51, see Figure 1 and Figure 3 for results by scenario. Also as with Study 1, the effect of condition (confirming vs. correcting report) holds in an ANOVA controlling for political ideology and initial belief, and with scenario type as an additional independent variable, F(1, 690) = 63.66, *p* < .001, partial η^2 = .09. The main effect of scenario was not significant (p = .75), though the interaction between the two was marginally significant, F(2,690) = 2.89, *p* = .06, partial η^2 = .008.

Follow-up tests ran within each scenario type showed the main effect of report type held for each scenario, all *p*'s < .001 (see means in Table 5).
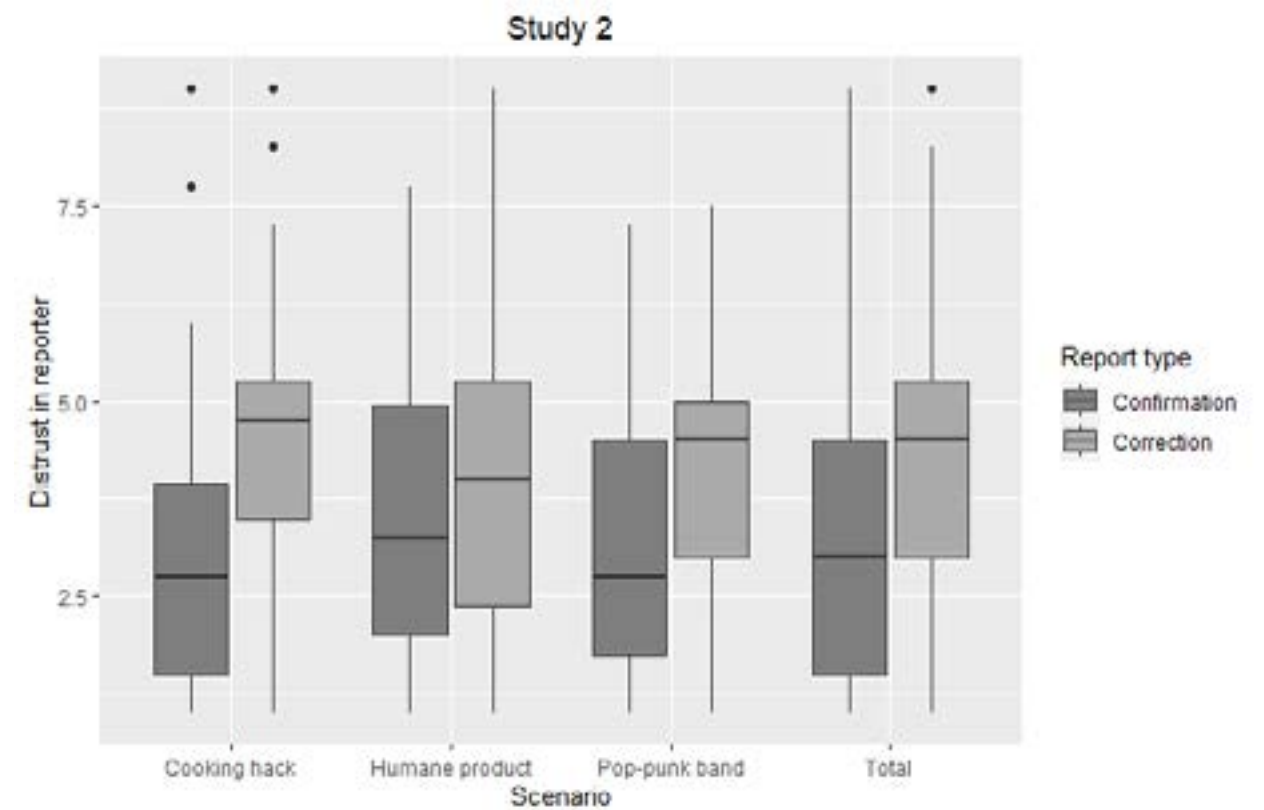
Fig. 3. Distrust in reporter for Study 2, by scenario and report type. Total-level data is included for reference.

Mediation and "surprise" analysis. We conducted the same mediation analysis as in Study 1, which again revealed indirect effects the "more information needed" question, B = .37, [.26, .50], and "surprise" question, B = .28 [.14, .44], and a direct effect of condition, B = .39 [.14, .64].

We conducted the same follow-up "surprise" analysis as in Study 1, looking at whether the report was surprising relative to prior beliefs. The full results of this analysis are in Supplemental Materials Section 4.

Most relevant, and again replicating Study 1, we found a main effect of condition even among participants who had initial beliefs consistent with the report. Again, participants were still relatively distrusting of a debunking consistent with their prior belief.

Impact on belief change. As with Study 1, belief change was moderated by distrust. A regression analysis again found that condition (false vs. true claim) and distrust interact to predict belief change, B = .37 [.20, .54], p < .001), such that distrust is associated with reduced belief change when correcting false reports, B = .34 [.22, .45], p < .001, but not in the confirming condition, B = -.03 [-.09, .15], p = .61). This interaction is plotted in Figure 2.

Discussion

Two studies supported the hypothesis that people are relatively distrusting of reports (i.e. thinking the reporters are dishonest) that correct false claims compared to reports that correct true claims. Results were mediated by people being more surprised and having higher bars of evidence for corrections compared to confirmations. However, people were still relatively distrusting of corrections that were consistent with their prior beliefs, and held across political ideologies. We suggest the best explanation for this is the innate negativity of corrections.

Moderators for this effect certainly exist. For example, people are quite likely to be fine with the debunking of what they consider outlandish conspiracy theories. So, we think it important to note that this investigation was limited to claims that people initially found on average subjectively plausible. We believe this to be the appropriate ground for investigation, though, as tomorrow's widespread misinformation presumably starts as today's subjectively reasonable claim for which a debunking attempt fails. This research proposes a novel theoretical mechanism behind the difficulty of correcting misinformation. Combining this with prior research, misinformation presents something of a "double whammy" in that its emotionally evocative character engenders sharing (Vosoughi, Roy, & Aral, 2018), and as we have shown people are relatively distrusting of attempts to correct it. If corrective reports are seen by some people as "being negative" as have suggested they are here, some people could indeed ignore, avoid, or resist fact checks or debunking just to avoid the negativity.

Regarding implications for communicative strategies, when possible, reporters should avoid "fact check" or "debunking" framings. Some researchers have had success with such strategies. For example, when presenting evidence intended to correct common misconceptions, asking questions that elicited beliefs from participants was more effective at changing beliefs than labeling misconceptions as "myths" (Powell et al., 2018).

Another potential strategy implicated by this research would be to look for ways to reverse the mechanics of negativity bias. For example, researchers of online reviews have also found a negativity bias, but one that works such that people put more stock in negative statements than positive – i.e., negative reviews are seen as more diagnostic of product quality than positive reviews (e.g., Chen & Lurie, 2013). Presumably this is because of the stakes involved. So, a strategy that might be appropriate in limited contexts is highlighting the consequences of belief. If people are told many believers in an alternative medical therapy end up spending large amounts on it, a debunking of the therapy might not seem as threatening.

Still, it is unrealistic to suggest that reporters could avoid the language of fact checks and debunking entirely. While fact-checkers could certainly change their framing, some amount of saying a notable claim is false is unavoidable. The best strategy might be that reporters, fact checkers, and any other institutions that deal with the correction of misinformation need to center trust-building as part of their mission.

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Monteith   **The Influence of Cough Airflows on Aerosol Transmission**
Liz

Abstract

With the COVID-19 pandemic still impacting all aspects of life across the globe, air velocity fields—especially those generated by coughs—must be considered in ongoing research as they have a significant impact on aerosol transmission. In this study, 100-micron, 20-micron, and 0.1-micron particles were studied. Using MATLAB, the aerosol transmission was simulated in the presence of airflow fields generated by an unobstructed cough. The results of the MATLAB simulation showed that as particle size decreases, the more significantly these particles were influenced by the flow fields of air. The cough was assumed to have a triangular profile, with a duration of 0.5 seconds and a maximum velocity of 10 m/s. All three particles traveled the distance the air from the cough traveled, which was 2.5 meters, or approximately eight feet; this is two feet over the CDC's social distancing recommendation. Moreover, the smaller the particle, the longer it stayed in the air. The 20-micron particle was in the air for at least two minutes, while the 0.1-micron was still in the air an hour after the initial cough. If these particles carry COVID-19 and are influenced by the air's flow fields, then they have great potential to infect other individuals. Thus, airflow fields are significant in magnifying aerosol transport and must be considered in public policy for the safety and health of the community.

Background

At the time of writing this report, the COVID-19 virus, first identified in 2019 in Wuhan, China, has caused a global pandemic that resulted in massive shutdowns of public places, restrictions in national and international travel, and economy instability. Scientists around the globe have rushed to understand the virus, its mutation pattern, and how it spreads. According to the Center for Disease Control and Prevention (CDC) in the United States, COVID-19 causes severe acute respiratory illness in infected individuals, who experience symptoms like fever, cough, muscle aches, and fatigue [1]. As of December 16th, 2021, there have been more than 50 million confirmed cases within the United States, and over 750,000 deaths caused by the virus [2]. While the United States has pushed to vaccinate the nation, only 61.1% of the population is fully vaccinated [2]. Countries around the globe have faced similar issues with vaccinating their populations and combined with the poor government handling of the pandemic, the virus was allowed to mutate and spread, making it more difficult to contain and stop the virus. However, despite the mutations, the COVID-19 virus has been discovered to spread through three main transmission modes. The three exposure pathways include the inhalation of very fine aerosol particles and respiratory droplets, the deposition of those particles on mucous membranes like the mouth, nose, and eyes, and finally the touching of mucous membranes by contaminated hands [3]. All these transmission paths have an origin point: the release of fine, respiratory droplets in the form of aerosols that are contaminated with the virus. Thus, aerosol transmission will be the focus of the research study.

To better understand how the virus spreads, it's important to acknowledge the research that the study is expanding upon. During the 2020-2021 school semester, an undergraduate research team working under the direction of Dr. Mingheng Li investigated how the size of an aerosol affects the velocity and displacement of the aerosol as it travels through the air [4]. For clarity, aerosols are fine solid or liquid particles that are typically invisible to the naked eye and usually suspended in a medium, like air. MATLAB, a technical computing software program, was used to model a series of differential equations based on Navier-Stokes's equations and Stokes' Law to see the effects of aerosol size of velocity and displacement. Four different aerosol sizes were tested: 300-, 100-, 20-, and 0.1-micron particles. Additionally, the particles were assumed to have a density of 1000 kg/m3 and an initial velocity of 20 m/s [4]. The results of the MATLAB simulation showed that as the particle decreased in size, it took longer for the particle to fall it the ground, its final vertical velocity decreased in value, and its horizontal displacement decreased as well [4]. As a result, the smaller particles—especially the 0.1-micron particle—stayed in the air long enough long enough that, if they contained viral contaminants, could be breathed in by another individual and infect them with the virus. For example, the 0.1-micron particle could stay suspended in the air for more than 10 hours, while the 20-micron particle remained in the air for approximately 2 minutes [4]. Thus, the size of the aerosol particle has a significant impact its velocity and displacement once released into the air, thus determining how likely the particle is in infecting another individual.

However, it is important to note some of the assumptions made during this study might have impacted the results. For example, the undergraduate research study assumed that the particles would not evaporate once they were released into the air and that the air itself was stagnant. However, these simplifications do not reflect reality. Respiratory particles released via coughs or sneezes are, to some degree, made of water which will begin to evaporate once released into the air. Evaporation would cause particle size to decrease, "affecting their displacement and velocity during their lifespan" [4]. Moreover, air is not stagnant, and has a velocity field that can be difficult to predict and simulate due to the fact it does not have a constant speed or direction; it is constantly changing. Thus, to improve on the previous work established by Cal Poly Pomona students in their undergraduate research, this study will focus on simulation the air flow fields that impact an aerosol's displacement and velocity once it is released into the atmosphere.

The study of velocity fields of air, or air flow fields, as a research topic predates the start of the pandemic, and many of these studies greatly advanced and aided this research study. For example, in a study lead by the Technical University of Denmark and Dr. Licina (2015), the "effect of the human convective boundary (CBL), room airflow patterns, and their velocities on personal exposure [to particles were] examined" [5]. While this research study focused more on the effects of the human convective boundary layer on airflows, this study had some key findings. Their results showed that "the most favorable airflow patterns are transverse flow from in from and the side [of the individual], as they can minimize, or sometimes eliminate, the exposure at the minimum velocity studied" [5]. In other words, airflow patterns effected the severity—or lack thereof—of exposure to an individual. Another study, conducted by Dr. Wei and Dr. Li at the University of Hong Kong and the Shenzhen Institute of Research and Innovation (2017), the cough flow, "characterized as a two-stage jet," was studied to better understand how they contribute to the "transmission of respiratory

diseases in indoor environments" [6]. Their research results showed that "larger expired volume and Reynolds numbers [resulted] in further spread of the cough flow," thus causing the respiratory particles to travel a farther distance [6]. The airflow vortex formed by the cough also "played an important role in enhancing the spread for larger particles" [6]. Essentially, the interaction of the environmental air flow field and the flow field of the cough influenced the travel of respiratory droplets. Finally, another impactful study, conducted by the University of Colorado and lead by Dr. VanSciver, Dr. Miller, and Dr. Hertzberg (2011) studied "cough generated infection aerosols… while developing strategies for the mitigation of disease risks… using particle image velocimetry (PIV)" [7]. Their results noted that coughs have a "high degree of variance in… velocity data," so a wide range of conditions must be considered to better model the phenomena [7]. The speed of the respiratory droplets in the cough were also found to reach a peak velocity before rapidly decreasing to match the velocity of the environmental air flow field.

While all three articles were incredibly informative, it is the last two articles that had the greatest impact on this research and will be the basis for advancing the knowledge of air velocity fields and how they affect the transmission of aerosols and other airborne pollutants through MATLAB. Previous research has established that the size of an aerosol particle significantly impacts the velocity and displacement of an aerosol once it is released into the environment. To improve upon the model that used Navier-Stokes's equations and assumed stagnant air, equations defining air velocity fields influenced by cough flow fields will be added to the analysis to get a better picture on aerosol transmission.

Objective

To utilize MATLAB, a technical computing software program, to program a series of differential equations based on Navier-Stokes's equations to simulate air flow fields generated by coughs and how it affects the velocity and displacement of an aerosol as it travels through the medium.

Nomenclature

a_x	Particle's acceleration in x-direction
a_y	Particle's acceleration in y-direction
C_c	Slip Correction Factor for Stokes law as a function of Knudsen number

C_D	Drag Coefficient as a function of Reynolds number
C_{x1}	Coefficient for the starting jet-stage of the cough
D	Diameter of the mouth
D_p	Particle's Diameter
g	Acceleration of gravity
F_{drag}	Fluid's Drag Force
Kn	Dimensionless Knudsen number
ρ_{air}	Air's density
$\rho_{particle}$	Particle's density
Re	Reynolds number
R_p	Particle's Radius
t_d	Extrapolated temporal origin of flow initiation
t_{dur}	Duration of a Cough
τ	Relaxation Time Constant
u_∞	Particle's velocity in stagnant fluid
$\boldsymbol{u_f}$	Moving fluid velocity vector
u_x	Particle's Distance in x-direction
u_y	Particle's Distance in y-direction
U_c	Characteristic velocity
$\boldsymbol{v_p}$	Particle velocity vector in a moving fluid
v	Fluid's kinetic viscosity
v_x	Particle's velocity in x-direction
v_y	Particle's velocity in y-direction

v_{mag}	Magnitude of the particle velocity
v_{air}	Air velocity
v_{max}	Maximum exiting velocity of a cough
x	Distance traveled by the aerosol
μ	Fluid's dynamic viscosity
λ	Mean free path of gas molecule
α, β, γ	Parameters in the Knudsen-Weber slip correction equation

Theory

Basic Theory and Equations

Before introducing the equations used to simulate cough airflow and the velocity field of surrounding air, the theory and equations used to simulate aerosol transmission from the previous undergraduate research study will be explained briefly. When particles move through in a fluid with a velocity of u∞, a drag force Fdrag is exerted on the particle [8]. The velocity of pressure of an incompressible Newtonian fluid can be expressed by the equation and continuity and the Navier-Stokes equation, as expressed in the following two equations, respectively [4]:

$$\frac{\partial u_x}{\partial x} + \frac{\partial u_y}{\partial y} + \frac{\partial u_z}{\partial z} = 0 \qquad (Eq.\,1)$$

$$\rho\left(\frac{\partial u_x}{\partial t} + u_x\frac{\partial u_x}{\partial x} + u_y\frac{\partial u_x}{\partial y} + u_z\frac{\partial u_x}{\partial z}\right) = \frac{-\partial p}{\partial x} + \mu\left(\frac{\partial^2 u_x}{\partial x^2} + \frac{\partial^2 u_x}{\partial y^2} + \frac{\partial^2 u_x}{\partial z^2}\right) + \rho g_x \qquad (Eq.\,2)$$

For the Navier-Stokes equation, only the equation for the x-direction is listed, though this study investigates how aerosols are affected in both the x- and y-directions. Next, the total drag force exerted on the sphere, derived from Stokes' law, is the following equation:

$$F_{drag} = \frac{\pi}{8} C_D \rho D_p^2 u_\infty^2 \qquad (Eq.\,3)$$

The above equation assumes an infinite medium, rigid sphere particle, no-slip at the sphere's surface, and accounts for the entire possible range of Reynolds number, Re, using the drag coefficient, CD. The drag coefficient is influenced by the air's density, viscosity, compressibility, as well as particle size and shape [9]. Depending on fluid flow, and in effect the Reynolds number, one of the following equations can be used to calculate Reynolds number [8]:

$$C_D = \begin{cases} \dfrac{24}{Re} & Re < 0.1 \ (\text{Stokes' law}) \\[2ex] \dfrac{24}{Re}\left(1 + \tfrac{3}{16}Re + \tfrac{9}{160}Re^2 \ln 2Re\right) & 0.1 < Re < 2 \\[2ex] \dfrac{24}{Re}\left(1 + 0.15\,Re^{0.687}\right) & 2 < Re < 500 \\[2ex] 0.44 & 500 < Re < 2 \times 10^5 \end{cases} \quad (\text{Eq. 4})$$

The transportation of aerosol particle is also affected by its interaction with the air's molecules. As a fluid particle moves, its path will be maintained until it collides with another molecule, changing the particle's path. This new direction would be maintained until the particle has another collision [4]. The mean free path, or λ, describes the average distance traveled by particle between collisions, which can experience a continuum or non-continuum dynamic system. The system is continuum if the particle size is significantly larger than λ, while the system is non-continuum if the particle size is significantly smaller than λ [4]. The relationship described above can be defined by the dimensionless Knudsen's Number, Kn [10]:

$$Kn = \frac{2\lambda}{D_p} \qquad (\text{Eq. 5})$$

As shown by the equation, the Knudsen Number is inversely proportional to the particle's diameter, D_p. Increasing Knudsen Numbers will cause the fluid resisting force to be smaller than what is expected by Stokes' no-slip boundary condition for the fluid at the particle's surface; in other words, the fluid system experiences non-continuum effect [2]. Therefore, a slip coefficient, C_c, can be introduced to Stokes' equation, where the slip coefficient is [8],

$$C_c = 1 + Kn\left[\alpha + \beta \exp\left(-\frac{\gamma}{Kn}\right)\right] \qquad (\text{Eq. 6})$$

with $\alpha = 1.257, \beta = 0.40$, and $\gamma = 1.10$.

Since u_∞ is composed of the fluid velocity, u_f, and the particle velocity, v_p, then u_∞ can be replaced $\boldsymbol{v} - \boldsymbol{u}$ in a moving fluid. Thus, combining Reynolds number and the slip correction factor in the drag force equations gives the following new equation for Stokes' Law:

$$\boldsymbol{F_{drag}} = \frac{\pi}{8C_c}C_D\mu D_p Re\left(\boldsymbol{u_f} - \boldsymbol{v_p}\right) \qquad (\text{Eq. 7})$$

This equation can be further simplified using the mechanical mobility, B, of the particle and relative velocity between gas and particle; the equation is $B = \frac{8C_c}{\pi D_p \mu Re C_d}$ [9]. This gives the following equation,

$$\boldsymbol{F_{drag}} = \frac{1}{B}\left(\boldsymbol{u_f} - \boldsymbol{v_p}\right) \qquad (\text{Eq. 8})$$

Finally, combining all the knowledge and equations above, the motion of an aerosol particle can be described using the drag force, buoyant force, and force of gravity, as shown using the equation below:

$$m_p \frac{d\boldsymbol{v_p}}{dt} = -\boldsymbol{F_{drag}} + \boldsymbol{F_{gravity}} - \boldsymbol{F_{buoyant}} \qquad (\text{Eq. 9})$$

$$\tau \frac{d\boldsymbol{v_p}}{dt} + \boldsymbol{v_p} = \boldsymbol{u_f} + \tau \boldsymbol{g}\left(1 - \frac{\rho_{air}}{\rho_{particle}}\right) \qquad (\text{Eq. 10})$$

All variables in bold in the equations above are vectors. Assuming that the particles are spherical, the relaxation time of the particle, or τ, can be written as [2],

$$\tau = m_p B = \frac{D_p^2 \rho_p C_c}{18\mu} \ (\text{Eq. 11}), \text{ with } m_p \cong \frac{\pi}{6}D_p^3 \rho_p \ (\text{Eq. 12}) \text{ as the mass of the spherical particle}$$

The relaxation time variable is used to simplify the force equations above, and it also provides the distance that the particle will travel before its velocity matches the air and starts falling [4]. It is important to note that the relaxation time depends heavily on the particle diameter [4]. As shown in previous undergraduate research, smaller particles are more easily influenced by their surroundings compared to larger particles [4].

Improved Equations and Theory:

Up to this point, the set-up for tracking the movement of aerosol particles has remained the same. However, this research study wants to incorporate the how the effects of air's velocity flow fields on particle transmission. Thus, going forward, the equations that discussed and implemented into the MATLAB code, will need to incorporate air velocity. First, the Reynolds Number equation, which affects the calculations of all equations, will need to incorporate the air's velocity. Thus, the following equation will be used:

$$Re = \frac{|v_{air} - v_{mag}|D_p}{v} \qquad (Eq.\,13)$$

In this equation, v_{mag} is the magnitude of the particle's velocity in the x- and y-directions, while v_{air} is air velocity. To obtain v_{air}, a velocity profile was developed. According to Dr. Wei and Dr. Li's research, the profile of a cough profile is the following,
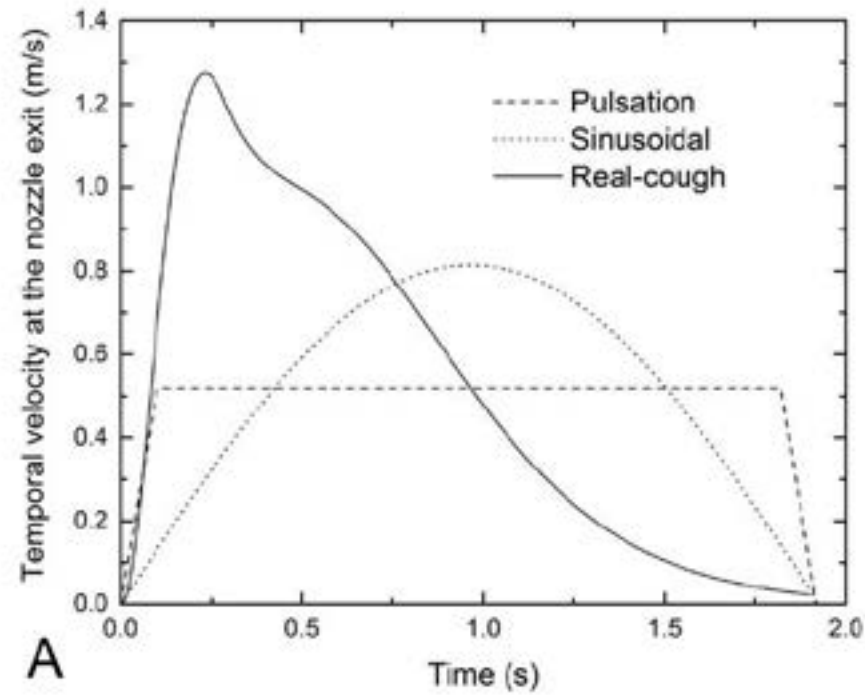
Figure 1: Temporal Velocity Profiles of Two Simulations and a Real Cough [6]

Using this graph of the real cough as a basis, the temporal velocity profile of the real cough can be assumed to be a triangular profile, which can be represented using the following equations:

$$v_{air} = \frac{v_{max}t}{\frac{t_{dur}}{2}} + 1e^{-8} \qquad (Eq.\,14)$$

$$v_{air} = \frac{v_{max}(t - 2)}{\frac{t_{dur}}{2}} \qquad (Eq.\,15)$$

In these equations, v_{max} is the maximum exiting velocity of a cough and t_{dur} is the duration of said cough. To make sure that Equation 12 does not experience calculation errors in MATLAB, 1e-8 is added to the equation. The triangular profile produced by these equations is demonstrated by the graph below:
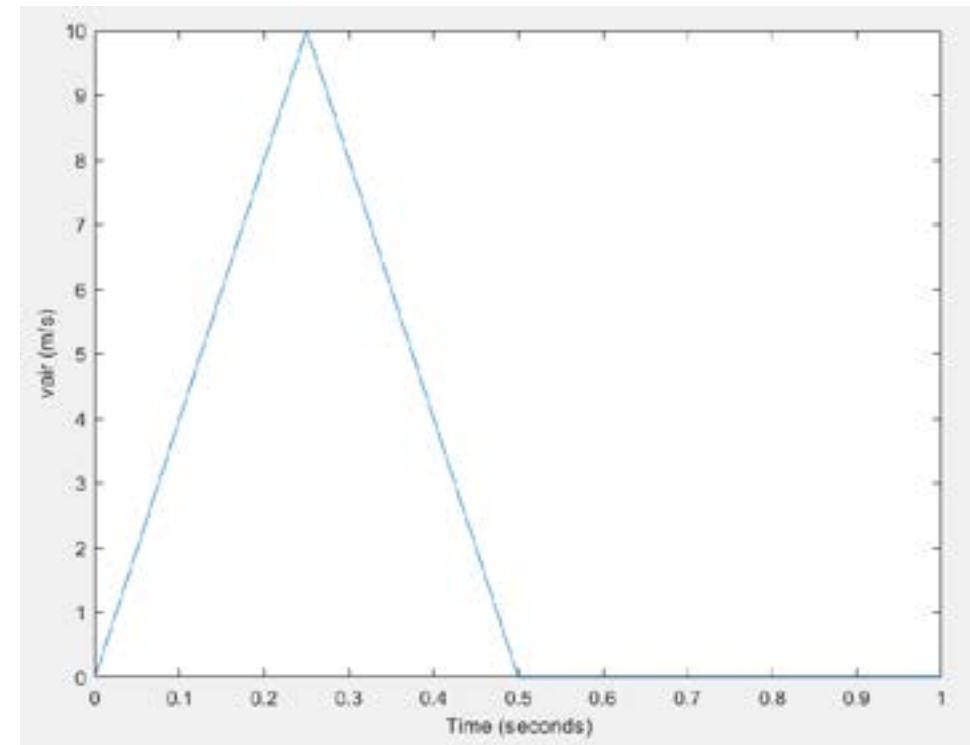
Figure 2: Triangular Profile of a Cough

To track the x-direction movement of a cough, a variation of the "streamwise penetration distances of the cough flow" equation is used [6]. That equation is as follows:

$$\frac{x - x_0}{D} = C_{x1}\left[\frac{U_c(t - t_d)}{D}\right]^{\frac{1}{2}} \qquad (Eq.\,16)$$

In this equation, D is the diameter of the mouth, C_{x1} is the coefficient for the starting jet-stage of the cough, U_c is the characteristic velocity, x is the distance traveled, and t_d is "extrapolated temporal origin of flow initiation" [6]. Assuming that x_0 and t_d are 0, the equation can be rewritten as,

$$x = DC_{x1}\left(\frac{U_c t}{D}\right)^{\frac{1}{2}} \qquad (Eq.\,17)$$

This equation will be used to track the horizontal distance that an aerosol particle travels once released into the air.

With these equations established, the acceleration profile for aerosol particle transmission can be described using the following six equations:

1. $a_x = \frac{v_{air} - v_x}{\tau}$

2. $a_y = \frac{v_{air} - v_y}{\tau} + g(1 - \frac{\rho_{air}}{\rho_{particle}})$

3. $\frac{dv_x}{dt} = a_x$

4. $\frac{dv_y}{dt} = a_y$

5. $\frac{dx_x}{dt} = v_x$

6. $\frac{dx_y}{dt} = v_y$

This acceleration profile is very similar to the one used in previous undergraduate research studies, but the incorporation of the theory and equations established earlier will produce more realistic aerosol transmission profiles to study. MATLAB will be used to produce an illustration of the displacement and velocity of the aerosol particle in the x- and y-direction over time.

Code Explanation:

Study of Aerosol Transmission with Air Flow Fields Considered – MATLAB CODE:

In addition to the several MATLAB code files that were developed previously [4], a couple more code files were developed to better illustrate and determine the velocity and displacement of aerosol particles. Like the previous study, evaporation effects were not considered; in reality, evaporation would cause aerosol particles to decrease in size, and increasing surface tension on the particle will increase the rate of evaporation [11]. MATLAB function files for the slip correction factor and drag coefficient were left unchanged, as these files did not contain any of the new or altered equations established in the Theory.

For this study, two new function files were developed. The first implements Equation 15 to track how the x-direction displacement of the aerosol particle changes over time. In this code, the diameter of the human mouth is assumed to be 2 centimeters, the characteristic velocity is 4 m/s, and the coefficient for the starting jet-stage is 2.9, as established in Dr. Wei and Dr. Li's research [6]. The second function file established the profile of v_{air} using Equations 12 and 13. The equations in this file produced a triangular profile for the air velocity flow field, which will in turn affect the velocity and displacement of the aerosol particle.

The last two files, one a function file and one a parameter and graphing file, are like the equation files used in Le, Monteith, and Tsan's research [4]. However, there are some key differences that consider the two new functions files and the fact that the air velocity profile is no longer 0 m/s and is influenced by the cough an individual produces. For example, the function file that sets up the velocity of the aerosol in the horizontal and vertical directions, as well as the displacement in the horizontal and vertical direction, has some slight changes. It still calculates the magnitude of the air velocity, Reynolds number, drag coefficient, the relaxation time constant, and the acceleration in the x- and y-directions, respectively. However, equations have been appropriately altered since the air velocity is no longer 0. The function file still sets up a matrix function, $\frac{dv_s}{dt}$, that is size 4 by 1. The first two equations are the acceleration of the particle in the x- and y-directions, respectively. The second two equations are the velocities of the particle in the x- and y-directions, respectively. When integrated, these equations will produce the velocity and the displacement of the particles, respectively. The last file executes and stores the function files, as well as necessary parameters for all the functions to run. These parameters are the same as the ones used in Le, Monteith, and Tsan's research: particle diameter, air density, mean free path of air, slip factor coefficient, gravity, dynamic viscosity of air, and particle mass. The temperature for the parameters that require it is 25 °C. To make sure all the MATLAB functions operate correctly, the following parameters were globalized: particle diameter, density of air, slip correction factor, dynamic viscosity of air, gravity, particle mass, and the velocity air profile. This file then solves the differential equations in the other function file was done using the ode15s function. A range of 0 to 3,600 seconds (or 1 hour) was used to observe the behavior of the particle in air. Different aerosol sizes were tested as well, including 0.1-, 20-, and 100-micron particles. With function code files for aerosol transmission explained, the results of the study can be detailed and investigated.

Results:
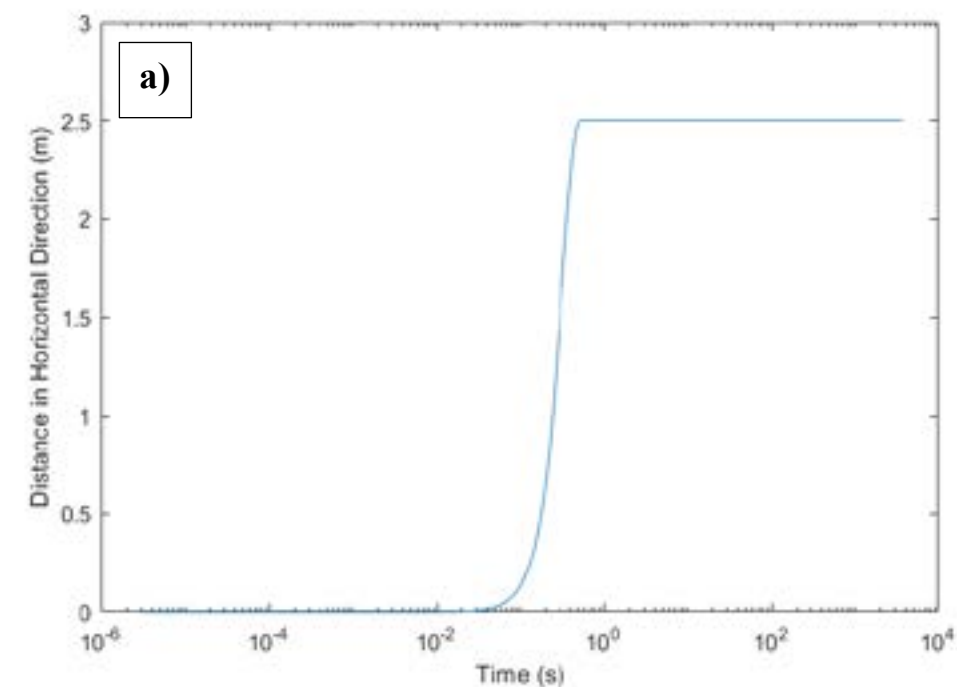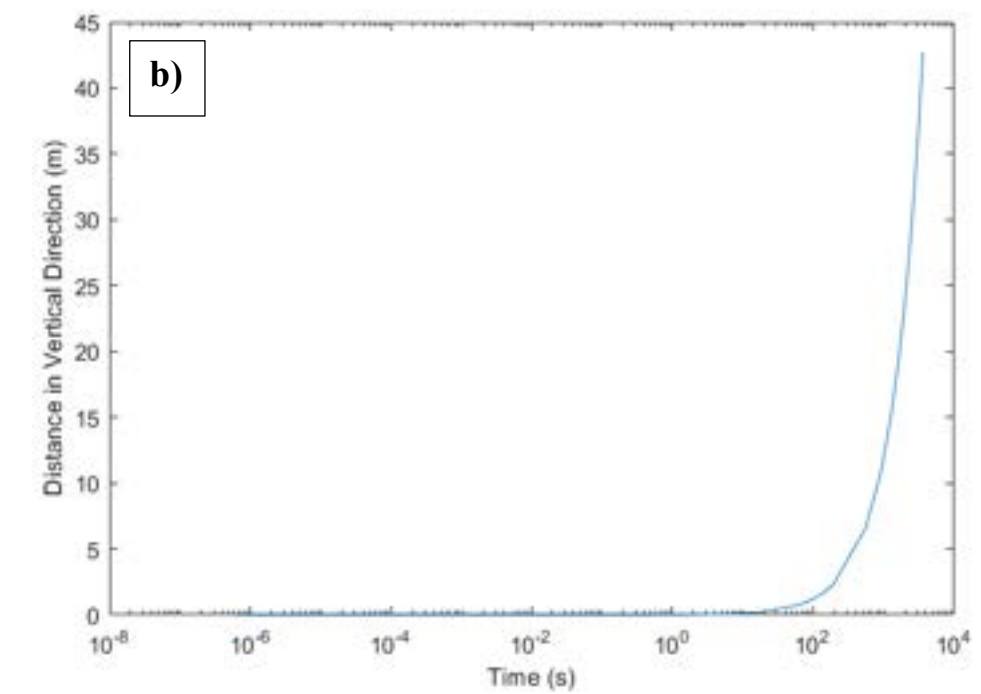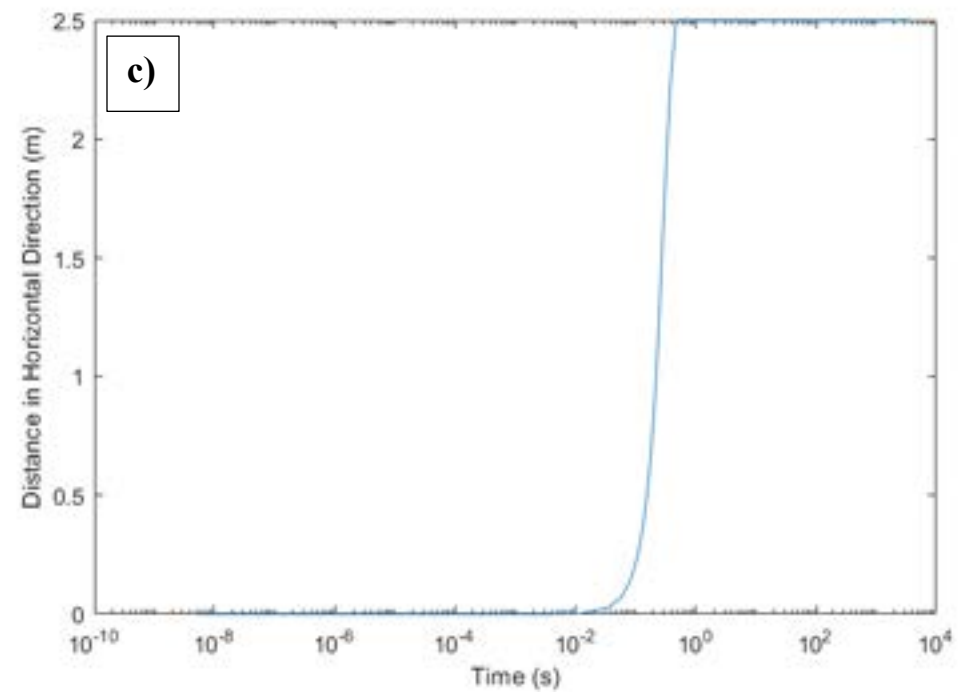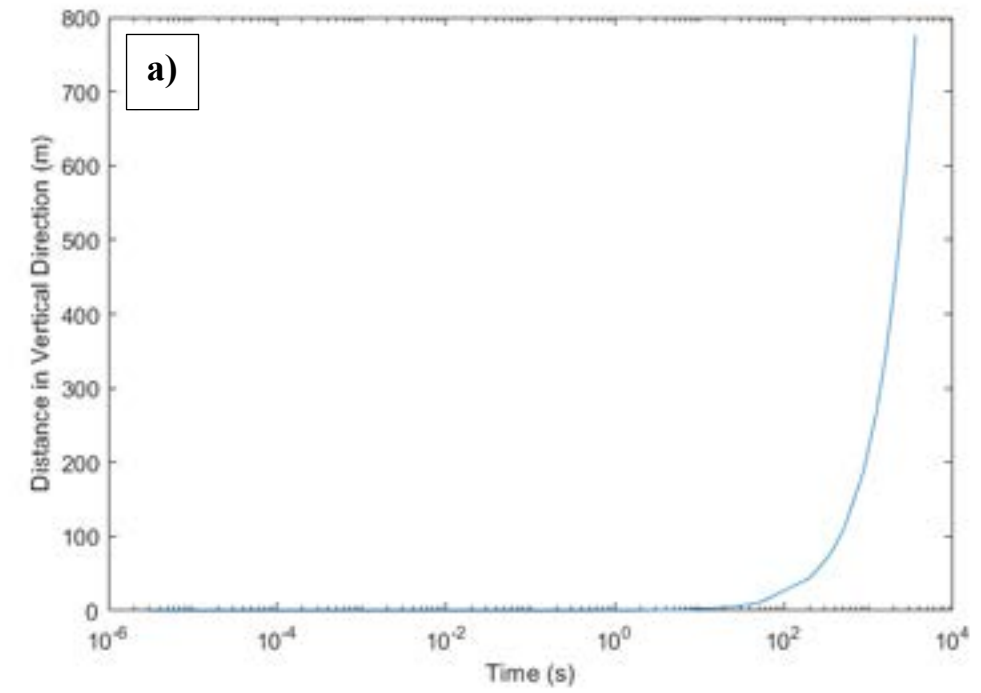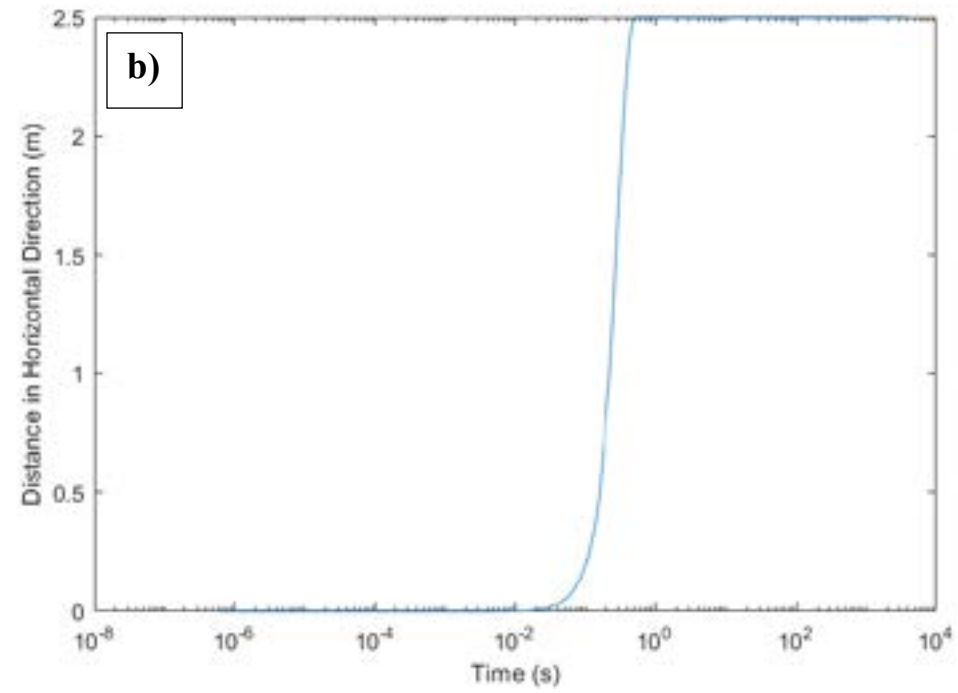
Figure 3: Horizontal Distance Traveled over Time, a) 100-, b) 20-, & c) 0.1-micron
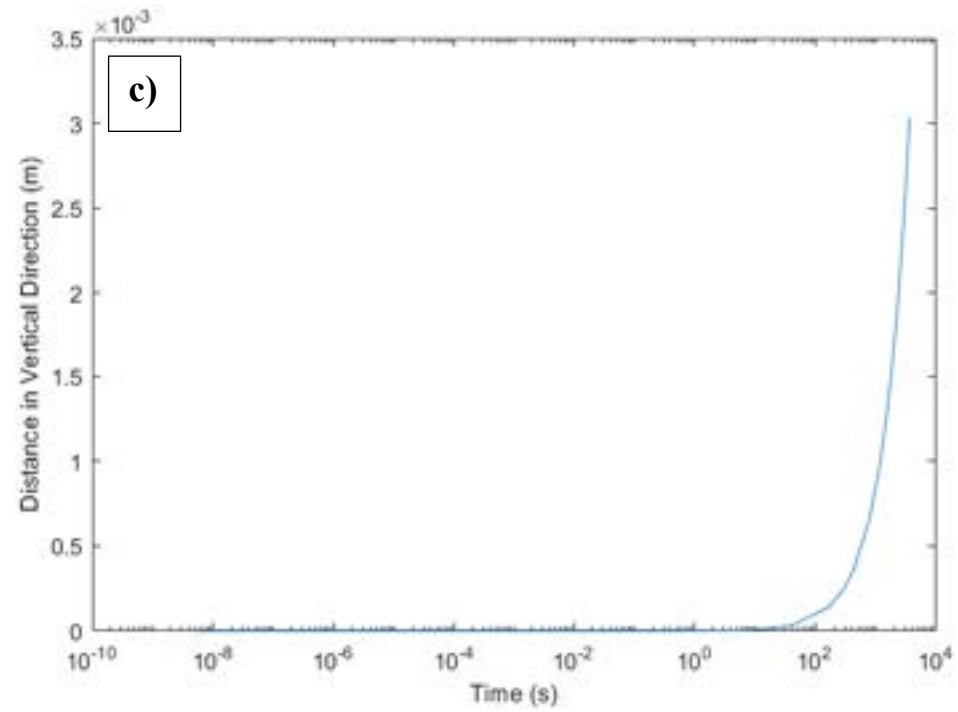
Figure 4: Vertical Distance Traveled over Time, a) 100-, b) 20-, & c) 0.1-micron
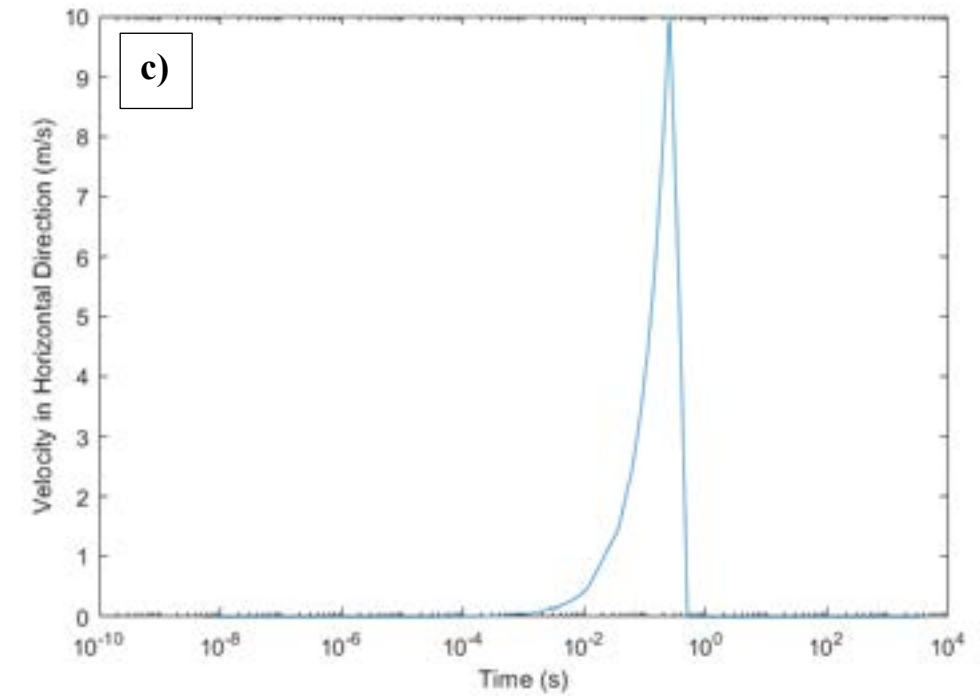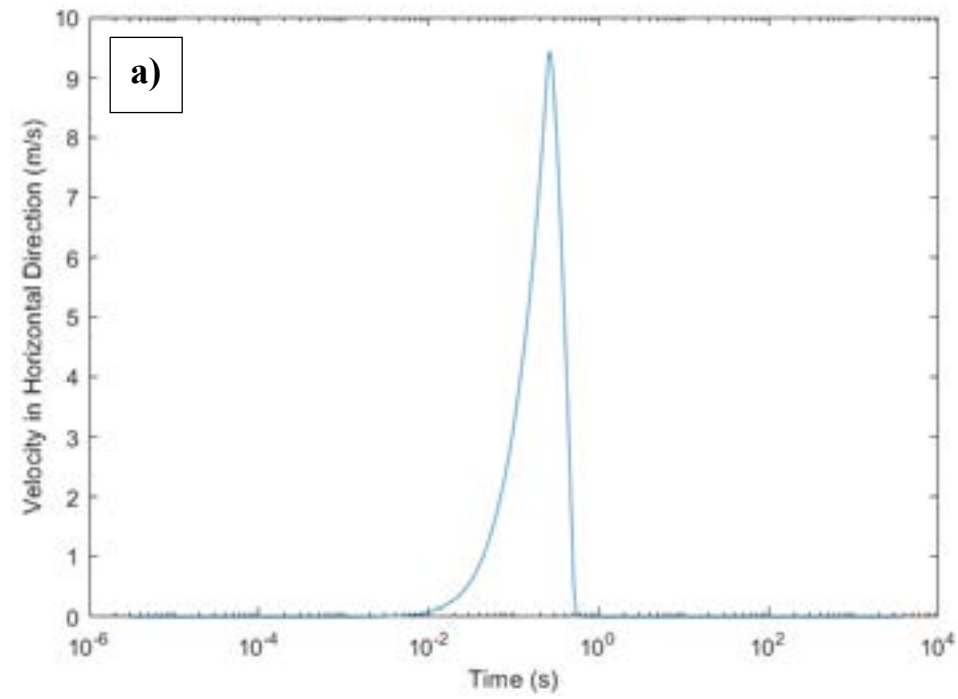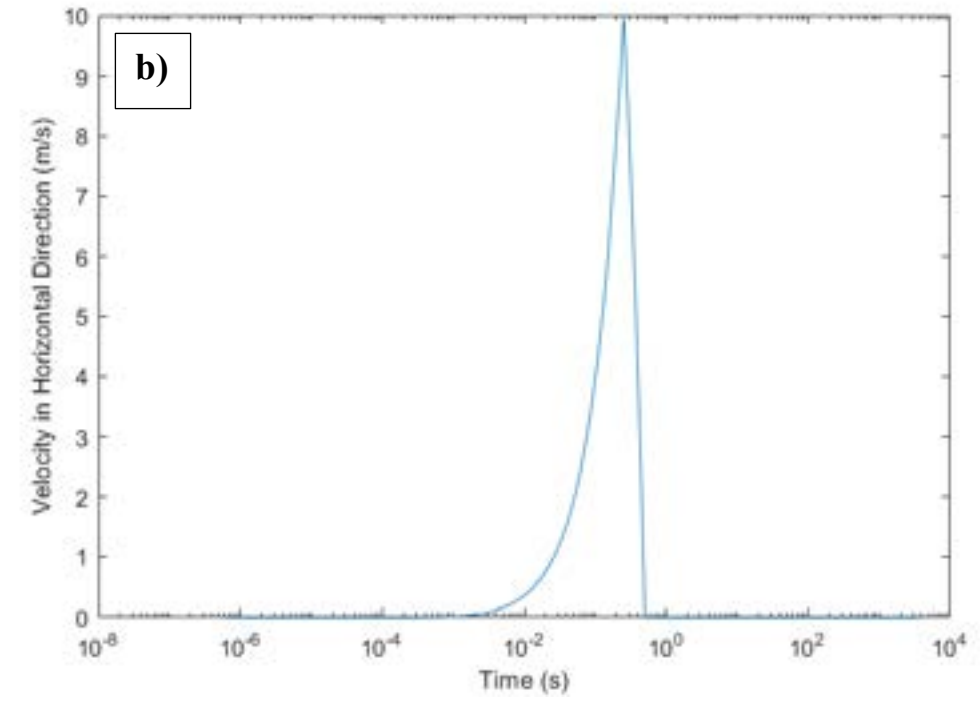
Figure 5: Horizontal Velocity over Time, a) 100-, b) 20-, & c) 0.1-micron
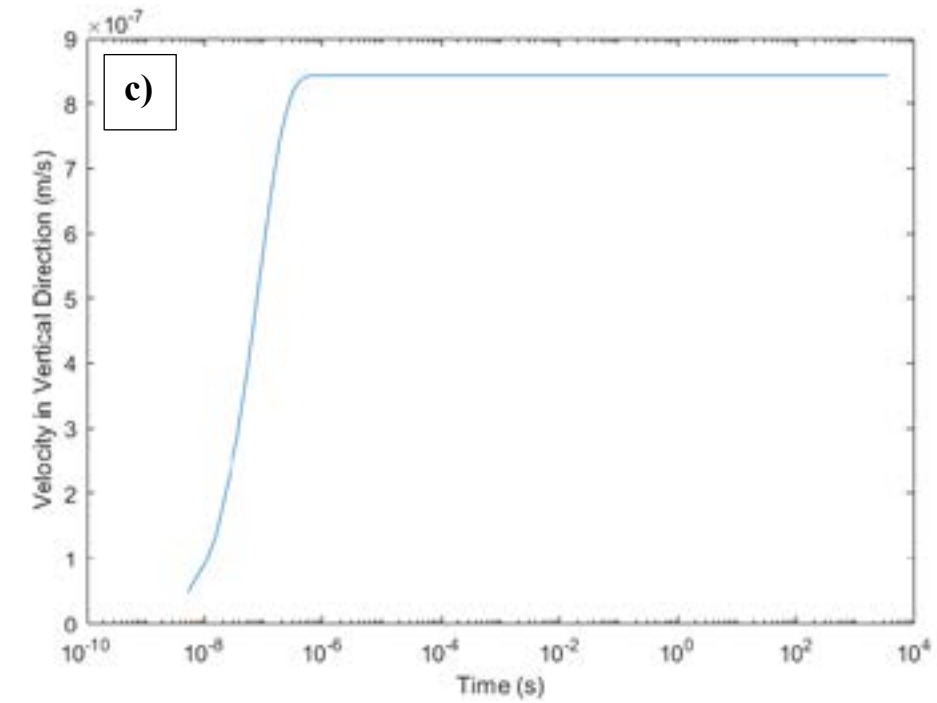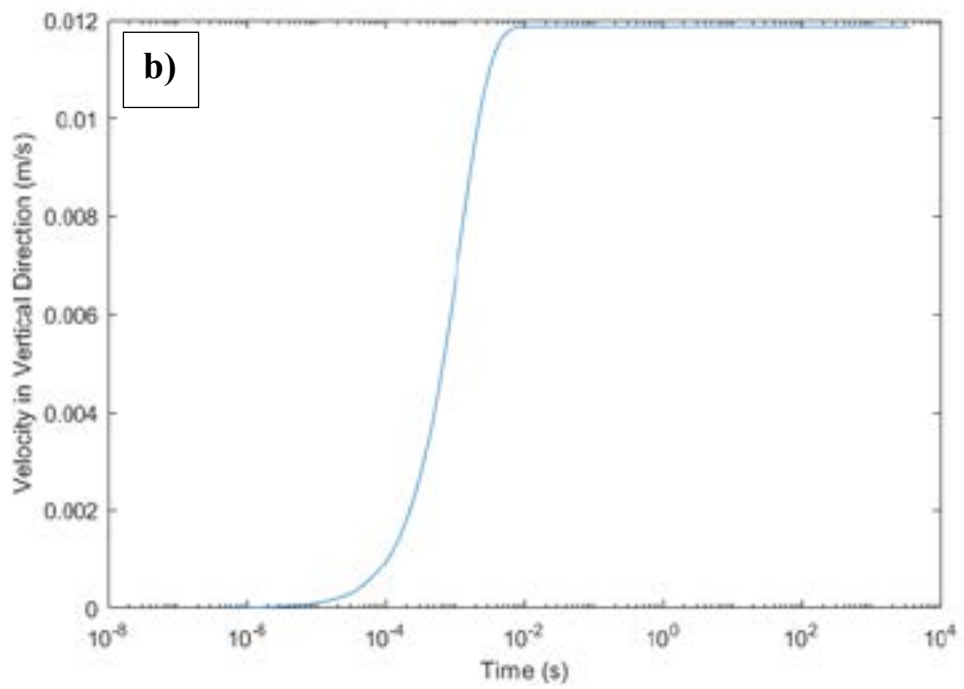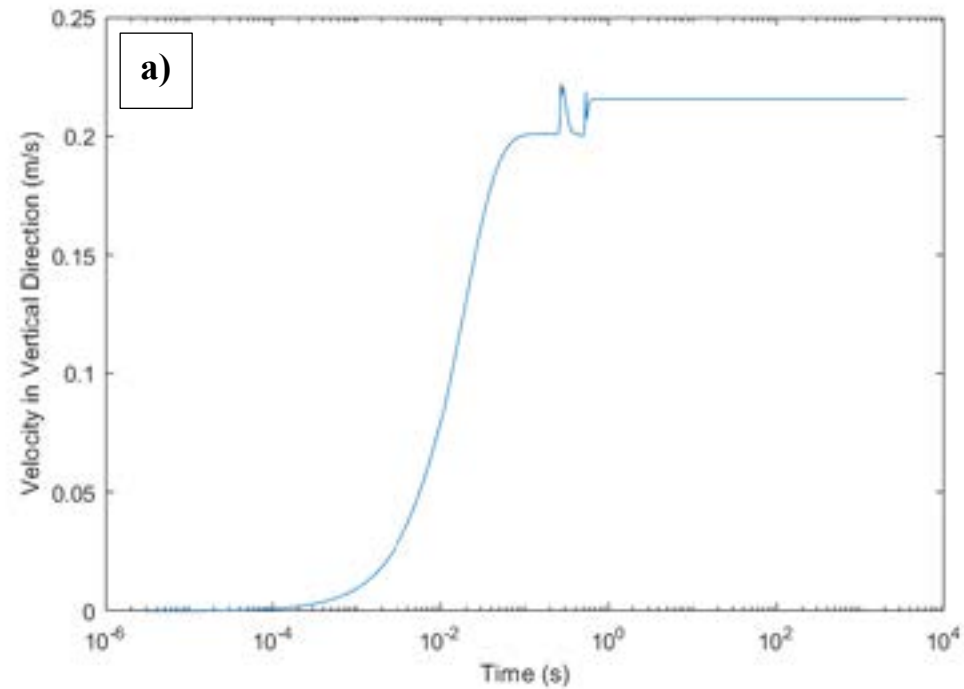
Figure 6: Vertical Velocity over Time, a) 100-, b) 20-, & c) 0.1-micron

Discussions:

Figures 3 through 6 show the displacement and the velocities of 100-, 20-, and 0.1-micron particles in the x- and y-directions. The differences in displacements of the three particles will be analyzed first, followed by the differences in velocities. It's important to note that the maximum speed of the cough was set to be 10 m/s and its duration was 0.5 seconds. As seen by the results and discussed below, these variables will influence the displacement and velocity of the particles.

Figure 3 demonstrates the horizontal distance traveled over time for the 100-, 20-, and the 0.1-micron particles. Remarkably, all three particles travel approximately 2.5 meters. Referring to Figure 2, the total horizontal distance traveled by the air from the cough is 2.5 meters. Thus, all three particles are significantly influenced by the speed of the cough. However, it is important to note that the size of the particle influences exactly how far the particle travels and how long it takes for the particle to reach that maximum horizontal distance. The 100-micron particle traveled 2.50016 meters, reaching its maximum distance at 0.67854 seconds; the particle travels slightly farther that the air from the cough. Since the 100-micron aerosol particle is larger than the other two particles, it has larger momentum and will not be as easily influenced by the air flow fields. Thus, the 100-micron particle will travel farther. It also takes the 100-micron particle longer to reach that maximum distance, longer than the duration of the cough, further indicating that the 100-micron particle is not as easily influenced by the air flow fields. As the particle decreases in size, so does the momentum and the distance the particle travels. The 20-micron

particle traveled 2.5 meters by 0.503751 seconds, traveling the same distance as the air. The 0.1-micron particle traveled 2.49997 meters by 0.499799 seconds, which is just under the 0.5 second duration of the cough. However, it is still extremely close to the distance travelled and duration of the cough. The smaller the particle is, the more easily influenced the particles are to the velocity fields of air. It's also important to note that 2.5 meters is approximately eight feet, which is two feet over the CDC's recommended six-foot social distancing recommendation. Thus, if aerosols have the potential to travel farther than six feet if carried by the air flow fields generated by a cough, the CDC's distancing recommendations will need to be updated to better protect people.

Figure 4 focuses on the vertical distance traveled by the three particles over time, which shows that it takes longer for the particle to fall as size decreases. The 100-micron particle took approximately 6.7218 seconds to fall 1.5 meters, which is the average height of an adult. The 20-micron particle took 124.5194 seconds to fall 1.5 meters, while the 0.1-micron only travels 0.00303157 meters in 3,600 seconds, or 1 hour. In other words, the 0.1-micron aerosol particle remains suspended in the air while the other two particles have already fallen to the ground. Assuming the 0.1-micron particle does not evaporate, the 0.1-micron particle is a significant contributor to the spread of the COVID-19 virus, as it remains in the air far longer than the other two particles and is more likely to be breathed in by another individual. The 20-micron particle also remains in the air for 124.5194 seconds, or approximately 2 minutes, which is still enough time for it to potentially be inhaled by another individual. To conclude, as the size of the particle decreases, the longer it stays in the air and the more likely it is to be inhaled by another individual.

The next two figures demonstrate the velocity of the three particles in the x- and y-directions. Figure 5 focuses on how horizontal velocity of the three particles over time. As a reminder, the relaxation time of a particle, or τ, is the time it takes for the particle to approach the velocity of the fluid stream it enters [10]. The smaller the particle is, the more easily the aerosol particle is influenced by the flow fields it is in. As shown in Figure 5, as the particle decreases in size, the more easily influenced the particles are by the cough flow fields and its maximum velocity will get closer to the speed of the air. The 100-micron particle reaches a maximum velocity of 9.41951 m/s at 0.264706 seconds, the 20-micron particle reaches 9.9663 m/s at 0.250763 seconds, and the 0.1-micron particle 9.99997 m/s at 0.250001 seconds. As the heaviest particle, the 100-micron particle's momentum is not as easily influenced as the 0.1-micron particle. The smallest particle does not have the size or mass to maintain its own momentum and is easily influenced by the flow fields generated by the cough. Similar results were also seen in the results of the Le, Monteith, and Tsan's undergraduate research [4]. Thus, these results corroborate with other research results in that the particle's size influences how easily it is influenced by the velocity fields of the air generated by the cough.

Another important result from Figure 5 is that, as the air velocity fields decreases to 0 m/s, all three particles similarly decrease to 0 m/s and do not maintain their own velocity for long. The duration of the cough is 0.50 seconds, after which the speed of the air is 0 m/s. The 0.1-micron particle reaches 0 m/s at 0.500001 seconds, almost the same time as the air. Once again, this is because smaller particles are more easily influenced by the velocity of its surroundings. The 20-micron particle, being slightly heavier, keeps moving a bit longer but reaches 0 m/s at 0.509631 seconds. The 100-micron particle, which is the heaviest, has greater momentum and keeps moving, reaching 0 m/s at 0.70326 seconds; this is approximately 0.2 seconds longer than the duration of the cough. These results show that, as the particle size decreases, the air velocity fields have a greater influence on the transmission of the particles and how fast or slow they travel.

Finally, Figure 6 demonstrates how magnitude of the vertical velocity decreases as the aerosol particle size decreases. The 100-micron particle reaches a maximum terminal velocity of 0.2156 m/s by 0.2156 seconds, 20-micron particle reaches 0.011876 m/s by 0.0167911 seconds, and the 0.1-micron particles reaches 0.842104 μm/s by 3.4547 microseconds. The relaxation time once again affects the terminal velocity each particle reaches; the smaller the particle, the faster is approaches the speed of the air. For this study, the vertical velocity of the air flow field was assumed to be 0 m/s; the air only had velocity in the horizontal velocity. However, due to gravity and the weight of the particle, the particles do not reach a final terminal velocity of 0 m/s. Since the 100-micron particle is the heaviest particle tested, it has the largest terminal velocity, and it takes the longest to reach this velocity. The smallest particle, the 0.1-micron particle, has the smallest terminal velocity and is the closest to the air's vertical velocity of 0 m/s. It also takes the smallest particle 3.4547 microseconds to reach its terminal velocity, which is quicker than the heaviest particle. Like the results in Figure 5, these results further show that the particle's size affects the particle's terminal velocity and how quickly the particle reaches it. It's important to note that the 100-micron particle's vertical velocity in Figure 6a has a few jumps and spikes as the particle reaches its final terminal velocity. Recall that the Reynolds number is calculated using the particle's diameter. In the code for calculating the drag coefficient, three different equations were used depending on the value for the Reynolds number. Thus, as the larger 100-micron particle reached its final terminal velocity, the Reynold's number likely changed enough to change the drag coefficient equation that MATLAB was using. This resulted in jumps and spikes that did not accurately reflect the aerosol's change in vertical velocity.

Collectively, Figures 3 through 6 show how aerosol transmission is influenced by the flow fields of air generated by a cough. As the size of the particle decreases, the more easily influenced the aerosols are by the flow fields. All three particles were carried by the air flow fields 2.5 meters, which is over the six-foot social distancing rule as established by the CDC. Furthermore, the smaller particles will remain in the air from two minutes to an hour after they were first released. Thus, air flow fields are critical in understanding aerosol transmission.

Conclusions

With COVID-19 pandemic entering its third year across the globe, it is still critical to understand aerosol transmission and how air velocity fields affect them. MATLAB was utilized to simulate aerosol transmission in the presence of air flow fields generated by an unobstructed cough. As the results have shown, the smaller the particle is, the more easily influenced they are by the air's velocity. While all particles travelled 2.5 meters in the horizontal direction, the largest particle took longer than the duration of the cough to travel 2.5 meters as its momentum was not as easily influenced by the air. The 0.1- and 20-micron particles, on the other hand, started and stopped their movement with the air flow fields; their displacement and velocity almost matched the air's. Furthermore, the smaller particles remained in the air far longer than the other particles. This is best demonstrated by the 0.1-micron particle, which was still in the air even after an hour from being first released. The 20-micron particle, while being larger than the 0.1-micron particle, is in the air for two minutes. If COVID-19 is being carried by these particles, they have significant potential to infect other people. Thus, these results, along with the results in similar research studies, should have a significant impact on public policy and requirements for indoor spaces. As discussed in the Results, 2.5 meters is approximately 8 feet, which is much larger than the 6-foot social distancing recommendation from the CDC. Thus, for indoor spaces, especially ones with poor ventilation systems, aerosol particles could easily transmit across the room. An infected individual that repeatedly coughs without covering their mouth would also increase the concentration of infectious aerosols in the area, posing greater risk to other individuals. Thus, it is critically important to study air flow fields, as they significantly impact aerosol transmission.

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Appendix

MATLAB Code:

"Calc_Cc.m" File:

```matlab
function Cc = Calc_Cc(Dp, lambda)
%Value of the slip correction factor is a function of Dp and
%the mean free path, lambda
Kn = 2*lambda/Dp;
Cc = 1 + Kn*(1.257 + 0.40*exp(-1.10/Kn));

%fprintf('\n The Slip Correction Factor is %.4f \n', Cc)
end
```

"Calc_Cd.m" File:

```matlab
function Cd = Calc_Cd(Re)

%% calculation of Drag coefficient as a function of Reynolds number.
if Re <0.1
    Cd = 24/Re;
elseif Re < 2
    Cd = 24/Re*(1+3/16*Re+9/160*Re^2*log(2*Re));
elseif Re< 500
    Cd = 24/Re*(1+0.15*Re^0.687);
else
    Cd = 0.44;
end
```

"x_t.m" File:

```matlab
function x = x_t(t)
D = 0.02; %D is diameter of the of the mouth in meters
C_x1 = 2.9; %C_x1 is the coefficient for the starting jet-stage
Uc = 4; %Uc is the characteristic velocity in m/s
x = D*C_x1*sqrt(Uc*t/D);
end
```

"vair_profile.m" File:

```matlab
function vair = vair_profile(t) %This stuff is from
https://doi.org/10.1371/journal.pone.0169235
td = 0.5; %cough duration in seconds
vmax  = 10; %max velocity of the exiting cough

if t<td/2;
    vair = (vmax)*t/(td/2)+1e-8;
elseif t<td
```

```matlab
    vair = vmax*(2-t/(td/2));
else
    vair = 0;
end
```

"Aerosol_Dyn_v2.m" File:

```matlab
function dvs_dt = Aerosol_Dyn_v2(t,vs)
global dp rhop rhog Cc mu g mp vair;

%% vs(1): velocity in the horizontal direction 0
%% vs(2): velocity in the vertical direction
%% vs(3): distance in the horizontal direction
%% vs(4): distance in the vertical direction

dvs_dt = zeros(4,1);
%% the following code was modified on 01/07/2022

vair = vair_profile(t);

vmag = sqrt(vs(1)^2+vs(2)^2);               % calculate velocity magnitude;
Re = dp*abs(vair - vmag)*rhog/mu;           % calculate Reynolds number;
Cd = Calc_Cd(Re);                           % calculate Drag coefficient
taup = Cc*4*rhop*dp^2/(3*mu*Cd*Re);         % calculate relexation time
constant
ax = (vair - vs(1))/taup;                   % acceleration in the x
direction
ay = g*(rhop-rhog)/rhop + (0 - vs(2))/taup; % acceleration in the y
direction

dvs_dt(1) = ax;
dvs_dt(2) = ay;
dvs_dt(3) = vs(1);
dvs_dt(4) = vs(2);
end
```

"Aerosol_Exec_Hub_v2.m" File:

```matlab
%% Voluntary coughs generated droplets ranging from 0.1 - 900 microns in
size. 0
%% Droplets of less than one-micron size represent 97% of the total number of
measured droplets contained in the cough aerosol.


%Aerosol Execution Hub
clear all;
global dp rhop rhog Cc mu g mp vair;

dp = 0.01e-6; %% diameter of aerosol
rhog = 1.184; %% density of air at 25C.
lambda_air  = 0.0651e-6; % mean free path of air at 25C.
Cc= Calc_Cc(dp, lambda_air); %% calculate slip factor
g = 9.81; % gravity
```

```
mu = 1.849e-5; % at 25C;
https://www.engineersedge.com/physics/viscosity_of_air_dynamic_and_kinematic_
14483.htm
rhop = 1e3; % density of aerosol;
mp = rhop*1/6*pi*dp^3;
t = 0:0.01:3600;
vair_vc = 5.565*exp(-4.418*t.*1); %From Source 7:
https://doi.org/10.1080/02786826.2010.542785
%When particle is released, particle and air gains acceleration then
decelerates

vp0 = 0;   % initial velocity of aerosol in the horizontal direction [m/s].
% Rep = dp*vp0*rhog/mu  % If Reynolds number < 1, it is in the Stokes region.
% tau = dp^2*rhop*Cc/18/mu;
% stop distance:
% stop_distance = tau*vp0

options = odeset('RelTol',1e-5,'AbsTol',1e-8);
[t,vs] = ode15s(@Aerosol_Dyn_v2,[0 3600],[vp0 0 0 0],options);

figure(1)
semilogx(t(:,1), vs(:,3))
%ylim([0 10])
xlabel('Time (s)');
ylabel('Distance in Horizontal Direction (m)');

figure(2)
semilogx(t(:,1), vs(:,4))
%ylim([0 1.5]); %Use if necessary
xlabel('Time (s)');
ylabel('Distance in Vertical Direction (m)');

figure(3)
semilogx(t(:,1), vs(:,1))
xlabel('Time (s)');
ylabel('Velocity in Horizontal Direction (m/s)');

figure(4)
semilogx(t(:,1), vs(:,2))
xlabel('Time (s)');
ylabel('Velocity in Vertical Direction (m/s)');

figure(5)
plot(vs(:,3),-vs(:,4))
ylim([-1.5 0]) %Use if necessary
xlabel('Distance in the Horizontal Direction (m)');
ylabel('Distance in Vertical Down Direction (m)');

t150 = interp1(vs(:,4),t,1.5)
dist_x = interp1(t,vs(:,3),t150)
```

The Influence of Cough Airflows on Aerosol Transmission

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Cal Poly Pomona Student RSCA Conference, 2022

BACKGROUND

❖ The COVID-19 virus has caused a global pandemic that resulted in significant shutdowns, restrictions, and economic instability across the globe.
❖ As of February 13th, 2022, there have been 77 million cases and 915,425 deaths in the US; only 64.4% of the population has been fully vaccinated [1].
❖ The COVID-19 virus has three main transmission modes; the most significant is the inhalation of very fine aerosol particles and respiratory droplets [2].
❖ A chemical engineering senior project group in 2021 used MATLAB to simulate simple aerosol transmission under the direction of Dr. Mingheng Li.
   • Results showed that the size of the aerosol particle had a significant impact on its velocity and displacement once released into the air [3].
❖ Research at the Shenzhen Institute of Research and innovation showed that cough airflows enhanced the spread of larger aerosol particles [4].
❖ Research at University of Colorado found that the speed of respiratory droplets in a cough reached peak velocity before rapidly decreasing to match the velocity of the environmental air flow field [5].
❖ This Capstone Project decided to improve upon previous undergraduate research by incorporating equations defining air velocity fields influenced by coughs into MATLAB to get a better understanding of aerosol transmission.
   • This is critical, as stopping the transmission of viral aerosol particles is necessary to stop the spread of COVID-19 and protect our communities.

OBJECTIVE

To utilize MATLAB, a technical computing software program, to program a series of differential equations based on Navier-Stokes's equations to simulate air flow fields generated by coughs and how it affects the velocity and displacement of three differently sized aerosol particles as they travel through the medium.

THEORY & CODE SET-UP

❖ Navier-Stokes equation, total drag force, drag coefficient, Reynolds Number, Knudsen's Number, slip coefficient, and relaxation time were used as a basis for the MATLAB simulation, and resulted in these six equations:

1. $a_x = \frac{v_{air} - v_x}{\tau}$
2. $a_y = v_{air}*v_y + g\left(1 - \frac{\rho_{air}}{\rho_{particle}}\right)$
3. $\frac{dv_x}{dt} = a_x$
4. $\frac{dv_y}{dt} = a_y$
5. $\frac{dx_d}{dt} = v_x$
6. $\frac{dx_d}{dt} = v_y$

❖ From this profile, it was assumed that the air velocity profile had a triangular profile. Thus,

$v_{air} = \frac{v_{max}}{t_{dur}}t + 1e^{-8}$ • $v_{air} = \frac{v_{max}(t-2)}{\left(\frac{t_{dur}}{t_{dur}}\right)}$

❖ A cough profile was used to approximate equations capable of tracking [4]:
   • The cough is assumed to reach a maximum velocity of 10 m/s at 0.25 seconds, and last for 0.5 seconds.
   • The distance travelled by the cough and aerosol was tracked using this equation [4]:

$x = D_{cx1}\left(\frac{t/\tau}{t_2}\right)^{1/2}$

❖ The MATLAB code was developed into a series of files. Function files for the slip correction factor, drag coefficient, x-direction displacement, air/cough velocity profile, and aerosol velocity profile were developed and housed separately. A final script file was used to execute all the function files, store results, and graph the velocity and displacement of the particles in the x- and y-directions, respectively.

RESULTS & DISCUSSION

Figure 1: Horizontal Distance Traveled Over Time

❖ The particle's size influences how far the particle travels and how long it takes to reach the maximum horizontal distance.
❖ Since all particles were relatively small, they travelled more or less the same horizontal distance.
   • The 100-micron particle, the largest and not as easily influenced by air flow fields, traveled 2.9006 meters in 0.679 seconds. The 0.1 micron particle, which is the smallest and most easily influenced by air flow fields, travelled 2.49997 meters in 0.4997 seconds.
   • 2.5 meters is approximately eight feet, which is *two feet over the CDC's six-foot social distancing recommendation.*

Figure 2: Vertical Distance Traveled Over Time

❖ It takes longer for the particle to fall 1.5 meters (average height of an adult) as its size decreases.
   • The 100-micron particle took 6.72 seconds, the 20-micron particle took 2 minutes, and the 0.1-micron particle *remained in the air after 1 hour.*
   • Thus, smaller particles stay in the air longer, and they are more likely to be inhaled by someone else.

Figure 3: Horizontal Velocity over Time

❖ **Relaxation Time:** The smaller the aerosol particle is, the more easily it is influenced by the flow fields it is in. • *Recall the cough reached a maximum velocity of 10 m/s at 0.25 seconds.*
   ❖ **100-micron:** v_{Hmax} = 9.42 m/s at 0.265 seconds
   ❖ **20-micron:** v_{Hmax} = 9.97 m/s at 0.251 seconds
   ❖ **0.1-micron:** v_{Hmax} = 9.99 m/s at 0.250 seconds
❖ The heaviest particle is not as easily influenced as the lightest particle. Nevertheless, airflows generated from coughs have significant potential to carry aerosol particles.
❖ Magnitude of the vertical velocity decreases as the aerosol particle decreases, which influences how fast the particle falls to the ground, as seen in **Figure 2.**
❖ Collectively, these results how aerosol transmission is influenced by the air flow fields generated by a cough. Small particles will travel more or less the same distance before failing to the ground after the cough profile reaches 0 m/s and the surrounding air is not disturbed.

CONCLUSIONS

❖ With the COVID-19 pandemic entering its third year across the globe, it is still critical to understand air velocity field's influence on aerosol transmission.
❖ MATLAB was utilized to simulate aerosol transmission in the presence of air flow fields generated by an unobstructed cough.
❖ As the results have shown, the smaller the particle is, the more easily influenced they are by the air's velocity.
   • While all particles travelled approximately 2.5 meters in the horizontal direction, the largest particle had more momentum and travelled slightly farther than the other two particles.
   • The 0.1- and 20-micron particles, on the other hand, started and stopped their movement with the air flow fields; their displacement and velocity almost matched the air's.
❖ Furthermore, the smaller particles remained in the air far longer than the larger particles, which could allow them to travel a longer distance if intermittent air movement is present.
   • If COVID-19 is being carried by these particles, they have the significant potential to infect other people.
❖ Thus, these results should have a significant impact on public policy and requirements for indoor spaces.
   • As discussed earlier, 2.5 meters is approximately 8 feet, which is above the 6-foot social distancing recommendation from the CDC.
   • For indoor spaces, especially ones with poor ventilation systems, aerosol particles could easily transmit across the room.
❖ Thus, it is critically important to study air flow fields, as they significantly impact aerosol transmission.

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Monteith Liz   **Aerosol Transmission and the COVID-19 Pandemic**

In 2020, a novel coronavirus called Severe Acute Respiratory Syndrome Coronavirus 2, or COVID19, started a global pandemic, forcing public places to shut down to prevent the spread of the virus. Resulting research has shown that, while infectious agents have multiple modes of transmission, COVID-19 predominantly spreads through droplet and aerosol transmission paths [1]. For clarifcation, an aerosol is the "suspension of small particles in air or another gas" [2]. Whenever people exhale through either their nose or mouth, droplets and aerosol particles are released into the surrounding air. Thus, when infected people sneeze or cough, viral particles are released into the air [1]. These viral particles thus have the potential to infect other individuals. Since these particles are considerably important to understanding and slowing the spread of the COVID-19 virus, it became critical to fnd methods to map the movement and speed of aerosol transmission in air. Under the direction of Dr. Mingheng Li, the aerosol project team researched aerosol transmission in relation to the COVID-19 pandemic. The project used MATLAB, a technical computing software program capable of computing and generating graphs based on mathematical equations, including diferential equations. In MATLAB, a series of diferential equations based on Navier-Stokes equations and Stokes' Law was developed that could track the velocity and displacement of an aerosol particle as it travels through the air. The results have shown that particle size signifcantly infuences the displacement and velocity of aerosol particle transmission, thus afecting how aerosols settle out of the air. Particles smaller than 0.1-micron can take hours to fall, while a 300-micron particle falls to the ground within seconds. The scope of this project and its result with further current knowledge and understanding on aerosol transmission and how COVID-19 spreads.

ACKNOWLEDGEMENT

BACKGROUND

The Severe Acute Respiratory Syndrome Coronavirus 2, or COVID-19, was frst identifed in 2019 in Wuhan, China. Despite attempts to contain the new virus, COVID-19 quickly spread to the rest of the world, starting a global pandemic that forced public places to shut down to prevent the virus's spread. COVID-19 causes severe acute respiratory illness with symptoms such as fever, cough, muscle aches, and fatigue [3]. As of April 1, 2021, there have been more than 128 million confrmed cases and nearly 3 million deaths from COVID-19 worldwide [4]. Consequently, scientists and health ofcials around the world have rushed to investigate how the virus spreads from infected individuals to others. They found that COVID-19 spreads in two main ways: inhaling the viral aerosols exhaled by an infected person or through contaminated surfaces [5].

However, it was the aerosol transmission that was found to be the most significant. The difusion of coronavirus-carrying aerosols can be compared to the difusion of cigarette smoke around a person. The closer the smoker, the denser the cloud.

The distance that these particles can travel in the air is also the distance the coronavirus can travel. To better understand how the virus spreads, researchers have implemented the use of software and simulation programs to model aerosol transport and virus transmission. For example, a study conducted by the Aalto University and the University of Helsinki in Finland employed a high-resolution Large-Eddy Simulation program to model aerosol dispersion and turbulent motion [6]. Their results showed that droplets with diameters of 50 to 100 μm could remain airborne from 3 minutes to 20 seconds [6]. While this may seem like an insignifcant amount of time, it is long enough for a nearby individual to inhale the viral particles and become infected. The researchers also simulated ventilation arrangements to determine how to reduce aerosol concentration in public spaces. However, "air fows are complex and often non-intuitive," so the only way to be sure a ventilation system works as expected was to actually test it [6]. Another research study, conducted by the University of Moratuwa and University of Sri Jayewardenepura in Sri Lanka, investigated the behavior of droplets and aerosols released from the cough of an infected person in confned spaces [1]. Their studies indicated that "droplets in the range of 0.5-20.0 micrometers lingering in the air are more likely to be retained in the respiratory tract and produce infection" [1]. Not only that, but the virus also "has been found to remain viable in aerosols for 3 [hours]" after which they were initially released [1]. Thus, airborne aerosol particles infected with COVID-19 have been shown to play a signifcant role in the transmission of the virus. While the spread of the coronavirus increased the emphasis on disease transmission through aerosol particles, it is important to note that this topic was being studied years before the pandemic. For example, in 2013 the U.S. National Institute for Occupational Safety and Health (NIOSH), built a mechanical cough aerosol simulation system "capable of generating an infection aerosol comparable to that seen in humans" and used it to study the dispersion and concentration of aerosols released by a cough [7]. The study's results showed that the concentration of viral particles was highest in the frst initial cough with most aerosol particles having a diameter that was a little over 0.1 μm. Itis also important to note that aerosols and droplets are distinguished by a diference in particle size. However, the size limit that distinguishes a droplet from an aerosol difers between reports and peer-reviewed articles. An article published by Mariano Zafra (2020) suggests that droplets are larger than 300 micrometers in diameter, while aerosol particles are less than 100 micrometers in diameter [8]. On the other hand, the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) states that particles larger than 5 micrometers are droplets and particles smaller than 5 micrometers are aerosols [1]. Nevertheless, droplets are considered to be larger than aerosol particles and can be seen by the naked eye, so they tend to fall quickly to the ground or the surface of objects due to gravity. Droplets can be large particles of saliva or mucus that are heavier than air produced by human physical activities, which include talking, coughing, and sneezing. Meanwhile, aerosols are a system of solid or liquid particles uniformly distributed and suspended in the air; they are smaller in size and difcult to perceive with the naked eye. As discussed in the paragraph above, aerosol particles can stay in the air for hours, thus potentially leading to an increase in airborne pathogens. While these research studies and investigations mentioned above are critical, they only focused on the concentration of aerosol particles

released into the atmosphere and how long they stayed in the air. They did not focus on the displacement and velocity of aerosol particles over time and how particle size infuences these parameters. While all viral particles have the potential to infect someone, some particles may be a more signifcant threat due to their size keeping them in the air longer. It is an undeniable fact that the size of the particles plays a vital role in determining the distance, direction of movement as well as the duration of the existence of the particles as well as the assessment of the spread of the COVID-19. Thus, this research study used MATLAB to develop this topic and expand knowledge on how particle size infuences its displacement and velocity.

OBJECTIVE

Using MATLAB, a technical computing software program capable of computing and generating graphs based on mathematical equations, a code using a series of diferential equations based on Navier-Stokes's equations and Stokes' Law will be developed in order to track and see how an aerosol's size afects the velocity and displacement of an aerosol as it travels through the air.

THEORY

To be able to understand the transmission pathway of COVID-19, the transportation of the particles will be studied under the infuence of diferent forces on the particles. Whenever there are particles moving in a fuid, drag force is one of the crucial factors to afect the motion of the aerosol particle. If the particle moves in the fuid with the velocity of $u\infty$, there will be a drag force Fdrag exerted on the particle [2]. The velocity and pressure in an incompressible Newtonian fuid can be expressed by the equation of continuity:

$$\frac{\partial u_x}{\partial x} + \frac{\partial u_y}{\partial y} + \frac{\partial u_z}{\partial z} = 0 \qquad (1)$$

And the Navier-Stokes equation in the x-direction:

$$\rho\left(\frac{\partial u_x}{\partial t} + u_x\frac{\partial u_x}{\partial x} + u_y\frac{\partial u_x}{\partial y} + u_z\frac{\partial u_x}{\partial z}\right) =$$

$$\frac{-\partial p}{\partial x} + \mu\left(\frac{\partial^2 u_x}{\partial x^2} + \frac{\partial^2 u_x}{\partial y^2} + \frac{\partial^2 u_x}{\partial z^2}\right) + \rho g_x \quad (2)$$

For a creeping flow with $Re = \frac{u_0 D_p}{v} \ll 1$, the solution for the above equations was obtained by George Gabriel Stokes, and his solution assumes an infinite medium, a rigid sphere particle, and no slip at the surface of the sphere. The Stokes' law states the total drag force exerted on the sphere is:

$$F_{\text{drag}} = 6\pi\mu R_p u_\infty \qquad (3)$$

Therefore, the total force on the sphere is the combination of drag force and buoyant force which is caused by pressure exerted on the particle. However, to be able to account for the entire range of Reynolds number, the drag coefficient C_D was introduced into the new expression:

$$F_{drag} = \frac{\pi}{8}C_D\rho D_p^2 u_\infty^2 \qquad (4)$$

The drag coefficient is dependent on the different properties of air such as the air's density, air's viscosity, and compressibility, as well as properties of the particle such as size and shape [9]. Moreover, C_D can be calculated based on Reynolds number as below [2]:

$$C_D = \begin{cases} \frac{24}{Re} & Re < 0.1(\text{Stokes' law}) \\ \frac{24}{Re}\left(1 + \frac{3}{16}Re + \frac{9}{160}Re^2\ln 2Re\right) & 0.1 < Re < 2 \\ \frac{24}{Re}\left(1 + 0.15 Re^{0.687}\right) & 2 < Re < 500 \\ 0.44 & 500 < Re < 2\times10^5 \end{cases}$$

$$(5)$$

Another factor that will affect the transportation of aerosol particles in the air is its interaction with the air's molecules. Normally, when fluid molecules move, they will continue their paths linearly until they collide with other molecules, their paths will change until another collision happens. The average distance traveled by a molecule between collisions is mean free path, λ. However, depending on the size of the particle and the mean free path of the fluid molecule, the observer of the system can see a continuum or a non-continuum dynamic. If the particle size is significantly larger than λ, the system is continuum (non-slip). However, if the particle size is significantly smaller than λ, the system is non-continuum. This relationship can be defined by the dimensionless group, Knudsen's Number, or Kn [2]:

$$Kn = \frac{2\lambda}{D_p} \qquad (6)$$

One of the assumptions of Stokes' equation was the no-slip boundary condition for the fluid at the surface of the particle. However, Knudsen Number is inversely proportional to the diameter of the particle, D_p. As D_p becomes smaller, the Knudsen Number increases which means the fluid system is under non-continuum effect as the resisting force by the fluid is smaller than what expected by Stokes' law [2]. Therefore, slip coefficient was introduced to correct the gap in Stokes' equation, as shown in Equation 7.

$$F_{drag} = \frac{3\pi \mu u_0 D_p}{C_c} \qquad (7)$$

With

$$C_c = 1 + Kn\left[\alpha + \beta \exp\left(-\frac{\gamma}{Kn}\right)\right] \qquad (8)$$

and =1.257, =0.40 , and =1.10
When $D_p > 10um$, the slip coefficient C_c is neglected as drag force is less than 2% error [2]. However, when D_p is roughly 0.1 um, the slip coefficient C_c must be included as drag force is reduced by a factor of 3. In a system of a particle moving in a fluid as shown in the diagram below, the u_∞ will be replaced by the relative velocity of the particle to the fluid $(\mathbf{v} - \mathbf{u})$.
From Equation 4, the Stokes' Law can be rewritten as:

$$\mathbf{F}_{drag} = -\frac{\pi}{8}C_D\rho D_p^2|\mathbf{v} - \mathbf{u}|(\mathbf{v} - \mathbf{u}) \qquad (9)$$

By combining the formula Reynolds number and slip correction factor, the newly obtained drag force is:

$$\mathbf{F}_{drag} = \frac{\pi}{8C_c}C_D\mu D_p Re(\mathbf{u} - \mathbf{v}) \qquad (10)$$

This equation can also be conveniently defined as the product of mechanical mobility, B, of the particle and
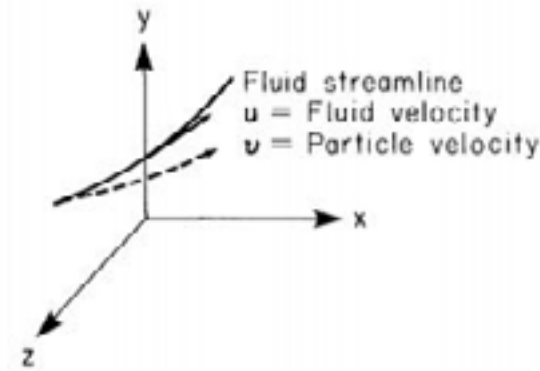
FIG. 1: Fluid and particle velocities

relative velocity between gas and particle. The equation, $B = \frac{8C_c}{\pi D_p \mu ReC_d}$ being the particle's mechanic mobility, which reflects the ability of an aerosol to reach constant velocity [10]. To investigate the motion of an aerosol particle in an external force field, a force balance can be derived:

$$m_p\frac{d\mathbf{v}}{dt} = -\mathbf{F}_{drag} + \mathbf{F}_{gravity} - \mathbf{F}_{buoyant} \qquad (11)$$

$$m_p\frac{d\mathbf{v}}{dt} = \frac{\pi D_P \mu ReC_d}{8C_C}(\mathbf{u} - \mathbf{v}) + m_p\mathbf{g} - m_f\mathbf{g} \qquad (12)$$

$$\tau\frac{d\mathbf{v}}{dt} + \mathbf{v} = \mathbf{u} + \tau\mathbf{g}\left(1 - \frac{\rho_{air}}{\rho_{particle}}\right) \qquad (13)$$

With

$$\tau = m_p B = \frac{4C_c\rho_p D_p^2}{3\mu C_D Re} \qquad (14)$$

τ is the relaxation time of the particle. It indicates how easily the particle got affected by the air movement. As the assumption of the particles being spherical, the can be rewritten as [2]:

$$\tau = \frac{D_p^2\rho_p C_c}{18\mu} \qquad (15)$$

With $m_p \cong \frac{\pi}{6}D_p^3\rho_p$ as the mass of the spherical particle. Relaxation time can be used to determine the stopping distance of the particle traveling in the air until it reaches the air's velocity and starts falling. In addition, the gravitational terminal velocity can also be calculated directly from relaxation time to find how long the particle lingers in the air until it hits the ground. Since the relaxation time is heavily dependent on the particle diameter, it increases extremely fast with increasing size. Therefore,

with a larger particle, they will stay longer in their original path. Meanwhile, the smaller particle is more sensitive to any changes in the environment and changes its path quickly. The smaller particles, due to small inertia, are more sensitive to air movement and are more likely to move around objects, and they possibly can travel further than larger particles as they can creep through small gaps. In fact, the air is rarely stagnant as any simple movements such as people's breathing, walking, and closing doors can cause disturbance in the air which results in different displacements of aerosol particles. To be able to analyze the pathway of aerosol particles, the movement of the particle will be broken down into two directions as shown below:

a. In horizontal direction:

$$\tau\frac{dv_x}{dt} + v_x = u_x \qquad (16)$$

b. In vertical direction:

$$\tau\frac{dv_y}{dt} + v_y = u_y + \tau g\left(1 - \frac{\rho_{air}}{\rho_{particle}}\right) \qquad (17)$$

Finally, the acceleration profile of aerosol particle transmission in the air is the following:

$$a_x = \frac{u_x - v_x}{\tau}$$
$$a_y = \frac{u_y - v_y}{\tau} + g\left(1 - \frac{\rho_{air}}{\rho_{particle}}\right)$$
$$\frac{dv_x}{dt} = a_x$$
$$\frac{dv_y}{dt} = a_y$$
$$\frac{dx_x}{dt} = v_x$$
$$\frac{dx_y}{dt} = v_y$$

By utilizing a set of equations to investigate the transportation of the virus in aerosol particles, the distance, as well as the velocity profiles of the aerosol particles traveling in the air, can be analyzed. The illustration of the projection of displacement and velocity of a particle in the air over a specific time range with a two-dimension perspective can be obtained by using the computational software MATLAB. Moreover, different particle sizes' projections would be compared under different airflow conditions.

V. CODE EXPLAINATION

Study in Stagnant Air, No Evaporation:

To determine the velocity and the position of aerosol particles as they travel through air, several MATLAB code

files were developed. It is important to note that, for the development of this code, the air was assumed to be stagnant with a velocity of 0 m/s. Evaporations effects on the aerosol particle were not considered as well. Once an aerosol particle is released into the air, evaporation effects will cause the aerosol's diameter to decrease in size. In turn, this increases the surface tension on the particle, which increases the vapor pressure over the particle, "increasing the driving force of evaporation" [2]. Thus, the speed and movements of the aerosol particle will be affected as the aerosol evaporated and decreased in size. However, to keep the code as simple and straightforward as possible, these effects were ignored. The particles' sizes were assumed to be constant. With these limitations explained, the MATLAB codes developed during this research project can be explained in further detail.

First, a MATLAB function file was created to calculate the slip correction factor as a function of the particle diameter, D_p, and the mean free path of the particle, λ. One of the key dimensionless groups that help calculate the slip correction factor was the Knudsen number. The second MATLAB function file develop was one that would calculate the drag coefficient based on the Reynolds number. Depending on the size of the Reynolds Number, the drag coefficient would utilize a different equation to calculate the drag coefficient. The equations used are listed in Equation 5. An "if-elseif" statement was then used to determine which equation above to use, all according to the value of the Reynolds Number. Next, a MATLAB function file was created to calculate the velocity and displacement of the aerosol particle, as well as its velocity magnitude, Reynolds number, drag coefficient, relaxation time constant, and the acceleration in both the x- and y-direction. The velocity magnitudes were calculated using initial velocity input values. The velocity magnitudes were then used to calculating the Reynolds number (Re). After defining Re, the drag coefficient, C_D, and the relaxation time constant were calculated. The relaxation time constant also affected the calculations of the accelerations in the x- and y-directions. For the y-direction, once the particle size becomes relatively larger, the uniform downward motion due to gravity dominates. The function file also set-up the differential equations of the velocity in the horizontal direction, velocity in the vertical direction, distance in the horizontal direction, and the distance in the vertical direction. This set-up also included printing the results into a matrix that can be accessed later. This function, called dv_s/dt, is a matrix function with the size of 4 by 1. The first two rows are the accelerations in x- and y-directions of the particle. When integrated, these equations produce the velocity of the particle. The last two rows are the velocities in x- and y-directions of the particle. When integrated, these equations produced the displacement of the particles. The output for this matrix function was time and a matrix 4 by 1. For the matrix output, the first two rows are velocities in x and y direction, the last two rows are positions in x and y direction.

Finally, the last MATLAB file developed was a file that stored the necessary parameters and executed the function files as detailed earlier. The necessary parameters that were defined are as follows: particle diameter, particle density, air density at 25 °C, mean free path of air at 25 °C, slip correction factor, gravity, dynamic viscosity of air, and particle mass. The initial velocity of the particle in the horizontal direction is also defined. These parameters were also globalized so they can be used in the MATLAB functions that were previously explained. With these parameters defined, solving the differential equations was done using the ode15s function. The initial velocity of the particle in the vertical direction was assumed to be zero, and the initial position of the particle was assumed to be (0,0). A range of 0 to 36,000 seconds (or 10 hours) was selected to observe the behavior of the particle as it travels and settles out of the air.

Study in Air with Acceleration in the x-direction:

The previous procedure assumes that the air, or the fluid the aerosol is traveling in, is stagnant with a velocity of 0 m/s. However, air is not truly stagnant; simple movements such as people walking around a room would cause the air to move. Air conditioners can also cause airflow. Since the air has movement and flow, this will affect the velocity and position of aerosols. However, the movement of airflow can be difficult to predict. Nevertheless, the fluid flow of air has a significant impact on aerosol particles; given enough time, the aerosol particle should reach the velocity of the fluid flow. To confirm this concept, a simple case was explored where the velocity of the air in the x-direction was maintained at a steady 0.5 m/s. The velocity of the air in the y-direction was left at 0 m/s. This simplistic case is not reflective of the realistic fluid motion of air, but it should be able to show that the aerosol is significantly affected by the motion of the fluid it is in.

VI.   RESULTS AND DISCUSSION

Study in Stagnant Air, No Evaporation:

Once the equations governing the movement of aerosols were coded into MATLAB, tests were performed on 300-, 100-, 20-, and 0.1-micron particles to understand how size influences the displacement and velocity of a particle. All particles were assumed to have a density of 1000 kg/m3. The initial velocity of the aerosol particles was set to be 20 m/s, which is the approximate speed of cough particles. It is also important to again note the air that the aerosol was traveling in was assumed to be stagnant with a velocity of 0 m/s. Evaporative effects on the aerosol particle were also not considered for this study. Evaporative effects would cause the released aerosol's diameter to decrease in size, thus changing the speed and movement of the aerosol particle. First, the horizontal and vertical displacements of the 300-, 100-,

20-, and 0.1-micron particles were investigated, and the graphs are included on the following page.

(a) 300-microns

(b) 100-microns

(c) 20-microns
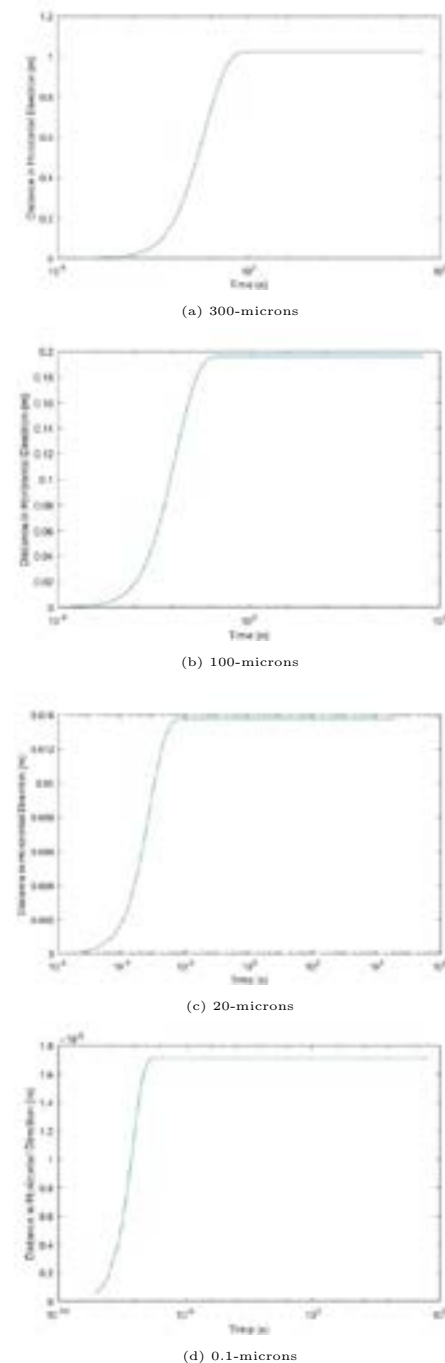
(d) 0.1-microns

FIG. 2: Distance Traveled in Horizontal Direction over Time, a) 300-, b) 100-, c) 20-, d) 0.1-microns

Figure 2 shows the horizontal displacement of an aerosol particle as it travels over time; as the particle size decreases, its horizontal displacement also decreases. The maximum horizontal distance the 300-micron par-

ticle travels is 1.0228 meters. Comparatively, the 100-micron particle travels 0.1964 meters, the 20-micron particle 0.0138 meters, and the 0.1-micron particle travels 1.7125x10-6 m, or 1.7125 micrometers. In other words, the 300-micron particle moves a significantly farther distance in the horizontal direction than the three smaller particles. Keep in mind, 1 meter is approximately 3 feet, so the 300-micron particle moves a little more than half of the social distancing length established by the CDC. This is because the 300-micron aerosol has a larger momentum due to its larger size and mass. As the aerosol particle decreases in size, so does its momentum, resulting in decreasing horizontal displacement. Therefore, the 100-, 20-, and 0.1-micron particles do not travel as far. The 300-micron aerosol also falls to the ground quicker, while the significantly smaller 0.1-micron particle remains suspended in the air; this will be demonstrated in Figure 3.

As shown by Figure 3, as the particle size decreases, the aerosol's fall time takes longer. The 300-micron aerosol particle takes approximately 1.45 seconds to fall 1.5 meters, or approximately 5 feet, which is the average height of an adult. The 100-micron aerosol particle takes approximately 7 seconds to fall 1.5 meters, and the 20-micron particle 122.5 seconds to fall the same distance. The 0.1-micron particle, the smallest particle out of the four, does not fall 1.5 meters within the 36,000 seconds, or 10 hours, timespan that was tested. The farthest the 0.1-micron particle traveled downward was 0.0303157 meters. Thus, the 0.1-micron aerosol particle is essentially suspended, remaining in the air hours after the 300-, 100-, and 20-micron particles have fallen to the ground. Thus, the 0.1-micron particle is a significant threat, and if COVID-19 is being carried by this particle, it could potentially be inhaled by another individual, infecting them with the virus. It is important to note that the 20-micron particle also stays in the air for a considerable amount of time before it begins to fall, more so that the larger 300- and 100-micron particles. Thus, the 20-micron particle can also be a considerable threat with the potential to infect someone with the virus. To conclude this section, Figures 1 and 2 demonstrate that the particle's size affects its displacement in the air. Next, the horizontal and vertical velocities of the 300-, 100-, 20-, and 0.1-micron particles were investigated, and the results are in Figures 3 and 4 below.

Figure 4 shows how that as the particle size decreases, the horizontal velocity of the aerosol decreases at a faster rate. For the 300-micron, the particle's horizontal velocity drops to 0 m/s by 1.1670 seconds, for the 100-micron particle 0.1693 seconds, for the 20-micron particle 9.9605 milliseconds, and for the 0.1-micron particle it takes 1.1483 microseconds. This supports the results shown in Figure 2; the heavier the particle, the more momentum it must travel farther and the longer it takes for its horizontal velocity to reach 0 m/s. Therefore, the 300-micron particle travels farther than the 0.1-micron in the horizontal direction. However, due to its weight, the

(a) 300-microns

(b) 100-microns

(c) 20-microns
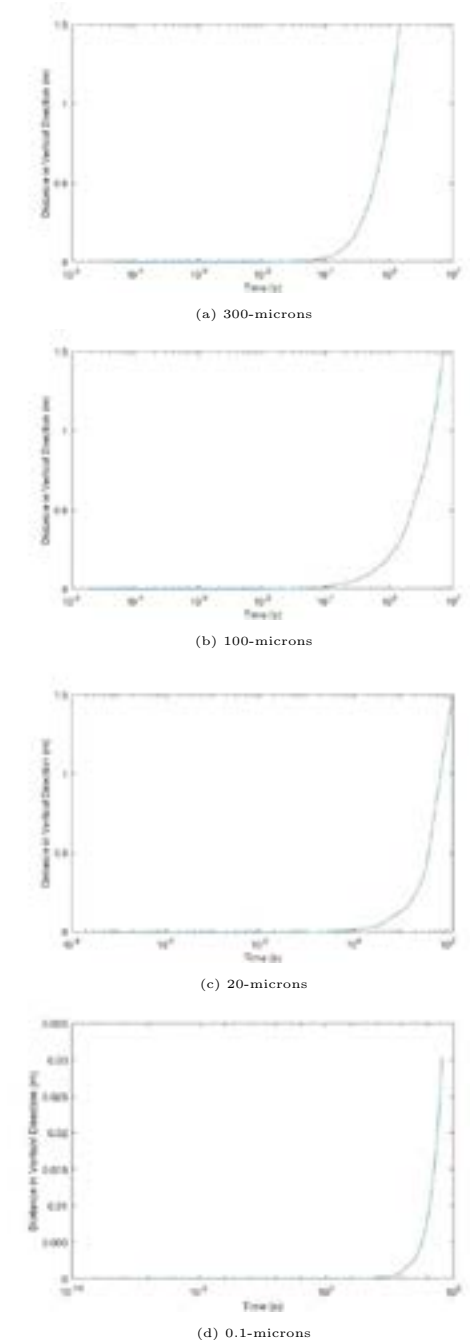
(d) 0.1-microns

FIG. 3: Distance Traveled in Vertical Direction over Time, a) 300-, b) 100-, c) 20-, d) 0.1-microns

300-micron particle also falls to the ground faster than the 0.1-micron particle, as shown in Figure 3. Next, the vertical velocities of the particles will be investigated to further explain this phenomenon.

Figure 5 displays how the vertical velocity of the aerosol changes with changing particle size. It is important to note that ultrafine aerosol particles are more likely to be

(a) 300-microns

(b) 100-microns

(c) 20-microns

(d) 0.1-microns

FIG. 4: Velocity in the Horizontal Direction over Time, a) 300-, b) 100-, c) 20-, 0.1-microns

(a) 300-microns

(b) 100-microns

(c) 20-microns

(d) 0.1-microns

FIG. 5: Velocity in Vertical Direction over Time, a) 300-, b) 100-, c) 20-, d) 0.1-microns

a final velocity of 0 m/s , or the velocity of the stagnant air. This is because the weight of the particle will yield a vertical velocity that pulls the particle down. Figure 5 also demonstrates that as the particle size decreases, the terminal velocity of the aerosol also decreases. The 300-, 100-, 20-, and 0.1-micron particles reach a terminal velocity of 1.16747 m/s. 0.2156 m/s, 0.01187 m/s, and 8.4210x10-7 m/s, respectively. Thus, these results further demonstrate that the size of the particle has a significant effect on the particle's final velocity and how fast it reaches that value.

In the graphs of the 100- and 20-micron particles of Figure 5, there is a noticeable bump in the curve as the velocity in the vertical direction increases from 0 m/s to its final terminal velocity. This bump in the curve is caused by the calculation of the Drag Coefficient, as it depends on Reynold's Number. Depending on the magnitude of the Reynold's number, four different equations for C_D were used, as discussed in the Theory section.

Finally, graphs were produced that compared the distance traveled in the vertical direction versus the distance traveled in the horizontal direction for the four aerosol particles. The results are included in Figure 6.

This final figure shows the relationship between horizontal and vertical displacement of the different particles. Initially, as the aerosol particle travels in the horizontal direction, the aerosol's vertical displacement does not change. However, as the aerosol particle reaches its maximum horizontal displacement, the aerosol's vertical displacement rapidly decreases until it reaches the ground. The larger the particle, the more gradual the change is from horizontal to vertical movement; this is shown in Figure 6a, where the 300-micron particle begins to descend before it reaches maximum horizontal displacement. As the particle size decreases, however, the forces that keep the aerosols airborne prevent the particles from falling until maximum horizontal displacement is achieved. This is clearly shown in Figure 6d, where the 0.1-micron particle travels almost completely in the horizontal direction before it begins its descent.

Relaxation Time Constant of $Particle < 1$ microns

As mentioned earlier, small aerosol particles are more likely to be influenced by the movement of air around it due to its smaller size and mass. To describe how easily an aerosol particle can be affected by the movement of air or the fluid around it, relaxation time is often used. The relaxation time, as mentioned before during the analysis of the particles' vertical velocity, "describes the time required by a particle entering a fluid stream, to approach the velocity of the stream"[11]. The constant can be calculated using the following equation[11]:

$$\tau = \frac{m_p C_c}{3\pi\mu D_p}$$

Initially, the relaxation constant is inversely proportional to the particle's diameter. However, it is important to

(a) 300-microns

(b) 100-microns

(c) 20-microns
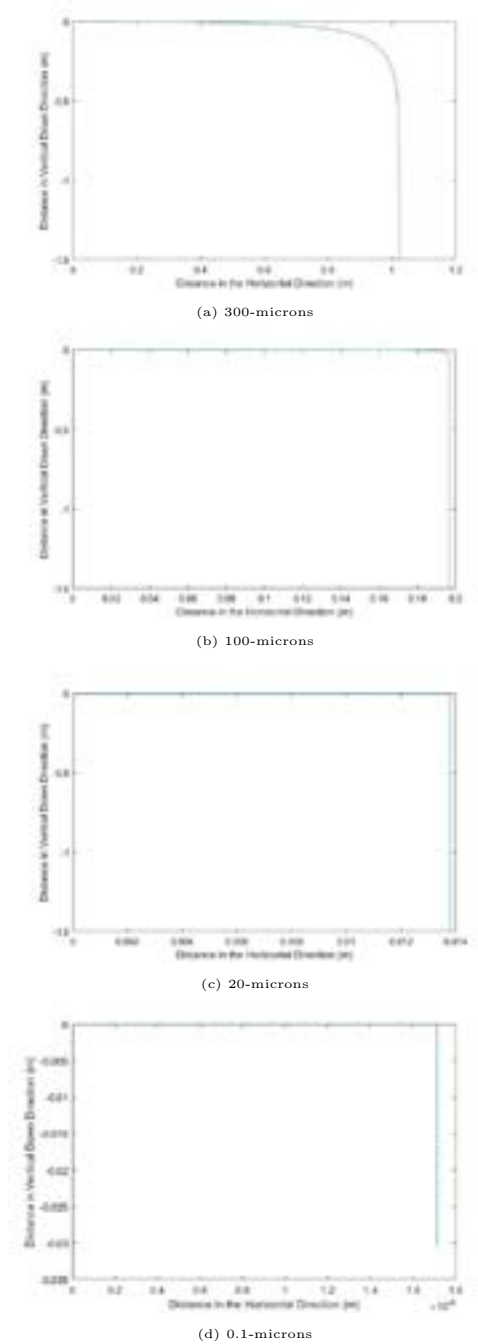
(d) 0.1-microns

FIG. 6: Distance Aerosol Travels Vertically as it Moves in the Horizontal Direction, a) 300-, b) 100-, c) 20-, d) 0.1-microns

note that the mass of the particle is proportional to its volume, which is roughly Dp^3, or the diameter cubed. Thus, the relaxation time constant is directly proportional to the square of the particle's diameter. Therefore, for exceedingly small diameters, the relaxation time constant will be extremely small. This means that the ultrafine particles are extremely sensitive to the fluid's

influenced by air movement around it due to its smaller diameter and mass. The relaxation time, or τ , "describes the time required by a particle entering a fluid stream, to approach the velocity of the stream" [11]. This term is used to describe how easily an aerosol particle is influenced by the medium it is in. As shown by Figure 5, as the particle decreases in size, it takes less time for

the particle to reach its terminal velocity. Both the 300- and 100-micron particles reach their final vertical velocity within one second, the 20-micron particle within 0.02 seconds, and the 0.1-micron particle within 1.3 microseconds. Thus, the smaller the particle is, the faster it approaches the velocity of the stream. It is important to note that, because of gravity, the particles do not reach

velocity. If any changes in the fluid's velocity occur, then the movement of the particle will also change accordingly. In fact, for small aerosol particles, Brownian diffusion frequently predominates [12]. The aerosol particle experiences Brownian diffusion with no order to the direction of motion, due to being buffered at random by surrounding air molecules. As the result, the smaller particle will show a smaller net displacement from their starting point and spend most of its time traveling in irregular path.

Study in Air with Acceleration in the x-direction

As stated in the Theory and Code Explanation sections, air is not truly stagnant, and its motion will have a significant impact on the aerosols in the medium. The following results follow the velocity and displacement of a 20-micron particle that has a constant velocity of 0.5 m/s in the x-direction. To reiterate, this simplistic case is not reflective of the realistic fluid motion of air. The results are on the following page:
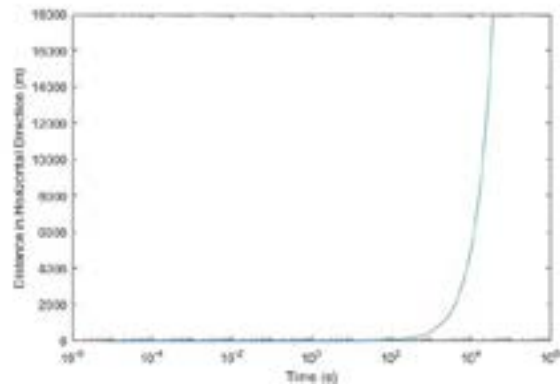
FIG. 7: Distance Traveled in Horizontal Direction over Time, 20 microns, vx = 0.5 m/s

FIG. 8: Distance Traveled in Vertical Direction over Time, 20 microns, vx = 0.5 m/s

The trends shown in Figure 7 are remarkably different compared to Figure 2c. Figures 1c and 2c reflect the

displacement of aerosols in a fluid that is stagnant. The results here, however, reflect the displacement of aerosols in a fluid that has a horizontal velocity of 0.5 m/s. As shown in Figure 7, the aerosol moves much farther in the horizontal direction within 36,000 seconds, or 10 hours. It is important to note that 18,000 meters is a significantly large distance for the aerosol to travel, which is not representative of aerosol travelling in a small space, like a classroom or restaurant. However, these results can show that the aerosol will travel significantly farther. Figure 8, on the other hand, is like Figure 3c; the 20-micron also takes a while to fall. After approximately 142.5 seconds, the 20-micron particle has fallen 1.5 meters. In other words, the 20-micron particle stays in the air for approximately 2 minutes and 10 seconds. Not only does the particle stay in the air for a considerable amount of time, but it is also able to travel much farther than the 20-micron particle in stagnant air. Thus, the aerosol is this scenario is much more likely to infect another individual.

FIG. 9: Velocity in Horizontal Direction over Time, 20 microns, vx = 0.5 m/s
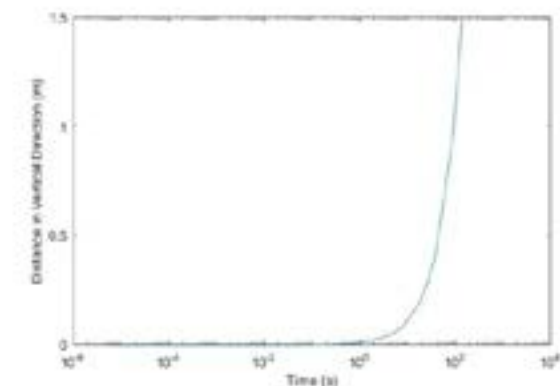
FIG. 10: Velocity in Vertical Direction over Time, 20 microns, vx = 0.5 m/s

Figures 8 and 9 show the 20-micron aerosol's velocity as a function of time in a fluid with a velocity of 0.5 m/s

in the x-direction. The trends in Figures 8 and 9 are remarkably like the trends in Figures 3c and 4c. However, there are a few key differences to take note of. Due to the horizontal velocity of the fluid, the aerosol's horizontal velocity approaches the air's velocity of 0.5 m/s. By the time 0.01 seconds have passed, the aerosol's velocity is the air's velocity; it does not reach 0 m/s. Another difference is the vertical velocity the aerosol approaches in the air. As shown by Figure 10, the aerosol starts with an initial vertical velocity of 0 m/s and it rapidly reaches 0.01055 m/s by 0.01 seconds. In Figure 5c, the aerosol's vertical velocity approaches 0.2156 m/s, which is considerably larger. The air's horizontal velocity affects the speed at which the aerosol falls, thus impacting the aerosol's vertical velocity.
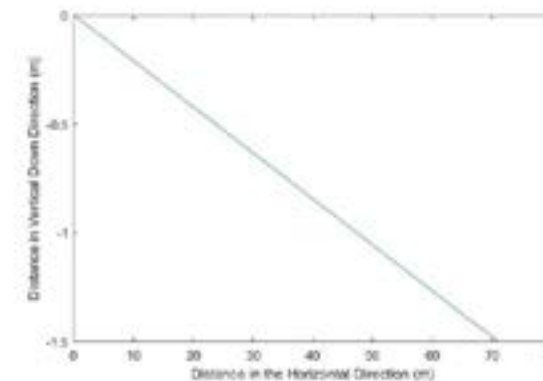
FIG. 11: Distance Aerosol Travels Vertically as it Moves in the Horizontal Direction, 20 microns, vx = 0.5 m/s

The results shown in Figure 11 are different compared to the results in Figure 6c. In Figure 6c, the aerosol initially travelled in the horizontal direction before it began to fall in the vertical direction. This is because the stagnant air did not affect the displacement of the aerosol. However, Figure 11 demonstrates the displacement of the aerosol in a fluid that has a horizontal velocity of 0.5 m/s. Thus, the 20-micron particle's displacement in the vertical and horizontal displacement changes simultaneously in a linear fashion. When the particle fell 1.5 meters, the aerosol has travelled 71.1 meters in the horizontal direction.

VII.   CONCLUSIONS

Aerosol particles and how they behave in the air are critical to understanding how they contribute to the spread of the coronavirus. The results produced by the MATLAB scripts show that the particle's size has a significant impact on its displacement and velocity. As the particle decreases in size, it takes longer for the particle to fall to the ground and its final vertical velocity decreases in value. This results in smaller aerosols remaining in the air far longer than larger particles. These smaller particles could potentially be breathed in by another indi-

vidual and, if the particles carry the COVID-19 virus, infect them with the virus. This is clearly demonstrated by the 0.1-micron particle, as it stays suspended in the air for more than 10 hours. If COVID-19 is being carried by this particle, it has significant potential to infect another individual with the virus. As discussed earlier, this study assumed that the particles would not evaporate once released into the atmosphere and that the air the particles were in was stagnant. Evaporation would cause the particles to decrease in size, affecting their displacement and velocity during their lifespan. Furthermore, air is not stagnant but instead is constantly moving in ways that can be difficult to predict. More work and research will be necessary to explore how these parameters affect aerosol movement. However, this study was still able to exhibit how a particle's size influences its displacement and velocity. While the 300-micron particle only remains in the air for a few seconds, the 0.1-micron particle can remain in the air for hours at a time. These parameters are crucial in reducing the risks of spreading the virus. Future work should incorporate the results of this study as well as the omitted parameters previously discussed into modeling aerosol dispersion using computation fluid dynamic software programs to better understand aerosol transmission and how to make indoor spaces safe again for public use.

Nomenclature

a_x	Particle's acceleration in x-direction
a_y	Particle's acceleration in y-direction
C_c	Slip Correction Factor for Stokes law as a function of Knudsen number
C_d	Drag Coefficient as a function of Reynolds number
D_p	Particle's Diameter
F_{drag}	Fluid's Drag Force
g	Acceleration of gravity
Kn	Dimensionless Knudsen number
R_p	Particle's Radius
Re	Reynolds number
u_x	Particle's Distance in x-direction
u_y	Particle's Distance in y-direction
v	Fluid's kinetic viscosity
v_x	Particle's velocity in x-direction
v_y	Particle's velocity in y-direction
α, β, γ	Parameters in the Knudsen-Weber slip correction equation
Λ	Mean free path of gas molecule
μ	Fluid's dynamic viscosity

ρ_{air} Air's density

$\rho_{particle}$ Particle's density

τ Relaxation Time Constant

u_∞ Particle's velocity in stagnant fluid

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IX.   APPENDIX

Appendix A: MATLAB Code (stagnant air, no evaporation of aerosol particles)

"Calc_Cc.m" File:

```
function Cc = Calc_Cc(Dp, lambda)

%Value of the slip correction factor is a function of Dp
and the mean free path, lambda
Kn = 2*lambda/Dp;
Cc = 1 + Kn*(1.257 + 0.40*exp(-1.10/Kn));
%fprintf('The Slip Correction Factor is %.4f ', Cc)
end
```

"Calc_Cd.m" File:

```
function Cd = Calc_Cd(Re)

% Calculation of Drag coefficient as a function of
Reynolds number.
if Re < 0.1
Cd = 24/Re;
elseif
Cd = 24/Re*(1+3/16*Re+9/160*Re^2*log(2*Re));
elseif Re < 500
Cd = 24/Re*(1+0.15*Re^0.687);
else
Cd = 0.44;
end
```

"Aerosol_Dyn.m" File:

```
function dvs_dt = Aerosol_Dyn(t, vs)
global dp rhop rhog Cc mu g mp;
% vs(1): velocity in the horizontal direction
% vs(2): velocity in the vertical direction
% vs(3): distance in the horizontal direction
% vs(4): distance in the vertical direction
dvs_dt = zeros(4,1);

% Rex = dp*abs(0-vs(1))*rhog/mu;
% if Rex < 1
% Fx = (3*pi)*mu*dp/Cc*(0-vs(1));
% else
% Cdx = Calc_Cd(Rex);
% Fx = -1/2*Cdx*pi*(dp^2/4)*rhog*(0-vs(1))^2;
% end

% Rey=dp*abs(0-vs(2))*rhog/mu;
%if Rey < 1
%Fy=mp*g+(3*pi)*mu*dp/Cc*(0-vs(2));
%else
%Cdy = Calc_Cd(Rey);
%Fy = mp*g-1/2*Cdy*pi*(dp^2/4)*rhog*(0-vs(2))^2;
%end
%ax = Fx/mp; % acceleration in the horizontal direction
%ay = Fy/mp; % acceleration in the vertical direction
% the following code was modified on 2/13/2021
vmag = sqrt(vs(1)^2 + vs(2)^2);
% calculate velocity magnitude;
Re = dp*abs(0-vmag)*rhog/mu;
% calculate Reynolds number;
Cd = Calc_Cd(Re);
% calculate Drag coefficient
taup = Cc*4*rhop*dp^2/(3*mu*Cd*Re);
% calculate relaxation time constant
ax = (0-vs(1))/taup;
% acceleration in the x direction
ay = g*(rhop-rhog)/rhop + (0-vs(2))/taup;
% acceleration in the y direction
dvs_dt(1) = ax;
dvs_dt(2) = ay;
dvs_dt(3) = vs(1);
dvs_dt(4) = vs(2);
end
```

"Aerosol_Exec_Hub.m" File:

```
%Voluntary coughs generated droplets ranging from 0.1
- 900 microns in size.
%Droplets of less than one-micron size represent 97% of
the total number of measured droplets contained in the
cough aerosol.
%Aerosol Execution Hub

clear all;
global dp rhop rhog Cc mu g mp;

dp = 20e-6; % diameter of aerosol
rhog = 1.184; % density of air at 25C.
lambda_air = 0.0651e-6;
% mean free path of air at 25C.
Cc= Calc_Cc(dp, lambda_air); % calculate slip factor
g = 9.81; % gravity
mu = 1.849e-5; % at 25C;
https://www.engineersedge.com/physics/viscosity_of_air_dynamic_and_kinematic_14483.htm
rhop = 1e3; % density of aerosol;
mp = rhop*1/6*pi*dp^3;

vp0 = 20; % initial velocity of aerosol in the vertical
direction [m/s].

% Rep = dp*vp0*rhog/mu % If Reynolds number ¡ 1, it
is in the Stokes region.
% tau = dp^2*rhop*Cc/18/mu;
% stop distance:
% stop_distance = tau*vp0;

[t,vs] = ode15s(@Aerosol_Dyn,[0 36000],[vp0 0 0 0]);

figure(1)
semilogx(t(:,1), vs(:,3))
xlabel('Time (s)');
ylabel('Distance in Horizontal Direction (m)');

figure(2)
semilogx(t(:,1), vs(:,4))
%ylim([0 1.5]); Use if necessary
xlabel('Time (s)');
ylabel('Distance in Vertical Direction (m)');

figure(3)
semilogx(t(:,1), vs(:,1))
xlabel('Time (s)');
ylabel('Velocity in Horizontal Direction (m/s)');

figure(4)
semilogx(t(:,1), vs(:,2))
xlabel('Time (s)');
ylabel('Velocity in Vertical Direction (m/s)');

figure(5)
plot(vs(:,3),-vs(:,4))
%ylim([-1.5 0]) Use if necessary
xlabel('Distance in the Horizontal Direction (m)');
ylabel('Distance in Vertical Down Direction (m)');
```

Morales Desiree   **Ethical Principles in the Non-Profit Sector: An Analysis of Accountability and Corruption in Philanthropy**

Abstract

This thesis looks to expand on and analyze the existing code of ethical standards that a nonprofit is meant to comply with both internally and externally in order to maintain confidence in the community as nonprofits are quite critical to social and civic engagement. Additionally, it will look at the extent of effectiveness these principles present in holding their organizations accountable to their board's comprehensive mission. The literature conducted will demonstrate a series of factors particular to the non-profit sector that contribute to an organization's universal success or failure. The concepts addressed in this research are the purportedly lax regulations and ethical standards surrounding nonprofit organizations which can allow for abuses of power in this sector. Principles are a necessary and essential part of organizational life and nonprofits hold unique characteristics that require special ethical context. Furthermore, the sector is rapidly growing, but studies on ethical principles and their effectiveness within these organizations is still fairly scarce. This paper will be analyzing in-depthly four different non profit organizations in the Health and Human services department, taking a particular look at the organization's code of ethics and probable misconduct to form a comprehensive conclusion of its effectiveness in maintaining its objective. These four organizations include: The American Red Cross, The Cancer Fund of America Inc., Goodwill Industries Inc. and The Bill and Melinda Gates Foundation.

Introduction

Nonprofit organizations have developed rapidly over the years in the United States, yet the regulation, audit and interest in management of many of these organizations has remained fairly scarce despite the fact that these groups lose millions to fraud annually, require different rules for assembling and benefit from various economic privileges that the government provides once they have been confirmed. As the government has expanded over the years, so has the need for these organizations which is why today the number of organizations registered with the IRS has surpassed over a million. In the past few decades the country's growing wealth, shift in capital and service management and developing stipulation for community care has accelerated investments into new foundations across the country (Smith, 2018). Though the concept of assisting and giving back to others dates back to theological times, the nonprofit sector in the United States is still, for the most part, relatively new. In the 1900's the U.S. went through an era of inflated socio-political activism and reform that helped give birth to policies on issues such as the women's right to vote, child labor protections, prohibition and more. The prosperity of this period would result in an increase in wealth that eventually led to the increase in giving back to the community for the purpose of enriching society. It wasn't until the 1940's during World War II when volunteering and fundraising in a collaborative effort took on a global scale and nonprofits such as the American Red Cross or the United Service Organization for National Defense (USO), among others, originated as relief and assistance programs (A brief history of nonprofit organizations: Nonprofit blog). By the seventies Americans became increasingly

vocal and organized in their efforts to address critical issues through the development of these societies while the government simultaneously became more interested in social and cultural assistance programs, eventually instituting the Tax Reform Act of 1969. This act introduced Section 501(c)3 in the IRS tax code which states that "every charity in the United States that meets specific criteria qualifies as a "private foundation," meaning it has a principal fund managed by its own trustees or directors" (A brief history of nonprofit organizations: Nonprofit blog). The policy essentially helped to distinguish a non-profit from a profit-driven business by informally creating a "third sector" because once organizations knew they could legally retain status as a charity and give tax exemptions to their donors the applications for 501(c)3 status quickly grew. With the creation of an official "nonprofit sector", more laws, regulations and policies were created as Congress and the government became more politically involved. Today however, a surge of corruption in the sector has emerged due to a number of factors which have contributed to the improper regulation and oversight being achieved at a number of these institutions, leaving room for the abuses of power that have occured in the last few decades. This has led to my interest in the philanthropic sector and my skepticism of the preservation of ethical principles within some of these organizations as corruption is on the rise and accountability for misconduct is low. I find this to be troubling as there are clear economic and social benefits that come with operating and leading a nonprofit and therefore it should be of significance to want to better understand how the latency of such ethical principles in nonprofits affects both the charity and subsequently the community it promises to serve. Nonprofit organizations are key-links to the efficient delivery of all types of services that may not otherwise be provided by the government or would be provided at a higher cost if it were not for the assistance that the sector supplies. Thus, the public tends to hold these organizations to a much higher ethical standard than the government or any other business.

It is necessary for this issue to be explored further in the field of Political Science, more specifically the subfield of Public Administration, due to the progressive nature of malpractice in the business of philanthropy. The sector continues to grow at a rapid pace, yet the interest in patterns of misconduct within some of these organizations does not necessarily mirror that growth. Nonprofit organizations are critical to society because they promote civic engagement and leadership, drive economic progress, and help to keep our communities together. Each and every day nonprofit organizations serve everyone in the United States in some way, whether they recognize it or not. This research looks to investigate a critical question in the field and further expand on some of the findings that have already been made which suggest that a lack of knowledge and importance for ethical codes in the philanthropic sector directly affects the charities legitimacy and effectiveness in fulfilling its objective. Two questions in particular are being considered in this thesis: 1) What is the general code of ethics in nonprofit organizations? and 2) To what extent are these ethics practiced and effective in evading corruption and holding these groups accountable to their board's mission? By analyzing what it means to be ethical, what factors influence ethical conduct and to what extent do these factors contribute to the challenges that nonprofit organizations face in circumventing fraud this thesis will try to better understand organizational culture particularly in this sector as it relates to the corruption and insufficiency of accountability which has been prevalent in recent years. Thus, when a nonprofit becomes engrossed by a breach of ethics it generally affects how communities view and interact with charities. With the use of survey analysis researchers have found that

nearly a third of Americans have "not enough" or "no faith" in philanthropic groups, and 70% believe that charitable organizations waste "a considerable lot" or "a reasonable bit" of money (Deborah L. Rhode & Amanda K. Packel, 2009). I propose that what currently hinders this sector is an absence of principles and the enforcement of these principles. Additionally, there is the temptation to commit financial fraud and the problem of conflicting interests which has permeated these charities. I predict that not having a robust foundation within your nonprofit which clearly exhibits a code of ethics that everyone is knowledgeable of and committed to following, ultimately risks the legitimacy of your organization and its goal because nonprofits hold unique characteristics that require special ethical context apart from that which we see in the for-profit sector. Further, I argue that external policies which currently govern these organizations need to be strengthened by the government so that internal processes can be better enforced and taken into consideration. To provide evidence for my argument I plan to utilize a qualitative approach to my research by using a variety of secondary data found in articles, journals and methodical studies of individual non-profit organizations that have experienced ethical wrongdoing, focusing mainly on their administrative principles and its consequences on the organization itself as well as its social reputation.

Literature Review

Researchers and scholars have affirmed different factors and theories for what leads some organizations to participate in unethical behavior. For starters, in all organizations, whether they are nonprofits or profit-driven, there are typically four main influences that distort judgment. These four influences include: 1) moral awareness 2) moral decision making 3) moral intent and 4) moral action (Deborah L. Rhode & Amanda K. Packel, 2009). Moral judgment ability and moral behavior varies greatly among people and components such as cognitive dissonance, cognitive biases, organizational structures and norms are just some of the few things that can affect or contribute to the judgements and behaviors that people commit. The literature found on ethicality and accountability in the non-profit sector identified fraud, whistle-blowing, conflicts of interest, a general lack of knowledge and consensus over a code of ethics and other organizational/managerial problems as some of the unresolved hurdles that face this area of the business sector. One of the biggest challenges that plagues these institutions however, is the issue of financial fraud. This type of misconduct has been found primarily among the organizations top leaders and executives who are entrusted with a great amount of responsibility to maintain the non-profits reputation and achieve its underlying mission. The people in leadership, particularly in a non-profit organization, are expected to preserve a certain integrity that others within the organization are encouraged to emulate, however, as some of the literature has suggested, leaders within these nonprofits have frequently failed to do so. According to Fremont-Smith & Kosaras (2003) within the nonprofit sector one study showed that out of one hundred and nine non profit organization officers, eighty-eight had been incriminated in one hundred and four criminal cases involving over one million dollars in charity funds. Additionally, among these officers, forty-four out of seventy-seven were also accused of breaching their fiduciary duty and were in positions of high importance such as CEOs and executive directors (Fremont-Smith & Kosaras 2003). This is a problem when it is generally recognized that people who choose to take positions in these organizations do so with the intention of constructing change in their communities and carrying out the objective that the

nonprofit has stated, rather than for the compensation. Executive directors also have an explicit role in supporting the work of their committee's and ensuring that the board of their organization is performing according to its stated purpose. As a consequence of these revelations it is not uncommon for nonprofit CEOs who do earn six or seven figure salaries to receive immense criticism as it is believed that this sector should not be subject to the same for profit attitudes. For instance in 2019, the CEO of the National Rifle Association, Wayne LaPierre came under fire after a series of internal documents leaked his six-figure lavish spending habits which were misused on expensive clothes, food and trips for himself and his wife (Mak, 2019). Moreover, it was reported that one of the most egregious parts of this corruption was that the company had "underfunded pensions affecting hundreds of former and current employees — even as LaPierre made $1.4 million in 2017" (Mak, 2019). This made many people who had supported the organization for years evidently very angry and ultimately distrusting of the goals that the nonprofit assured it was addressing. The reputation of a nonprofit is its most important virtue in trying to fulfill its undertaking, thus, failing to maintain this virtue could mean long-lasting effects that challenge the institution's overall success (Boucher & Hudspeth). If people do not trust the nonprofit, they are less inclined to dedicate any volunteer time to it or make any donations to the cause, which is ultimately what helps to keep these organizations alive.

Another illustration of this kind of financial abuse among leadership can be found in the salary of St. Jude's Ranch for Children CEO who was forced to resign after it was revealed that she was earning $300,000 a year, along with a $100,000 bonus and $35,000 in reimbursable expenses (Amaro, 2015). St. Jude's is a charitable organization that looks to serve abused, neglected and homeless children, thus, when the CEO is making a six figure salary, it brings into question just how much of the charity's profits are being used in the best interest of those that the charity claims to want to help. Above all, nonprofit organizations should be as transparent as possible with their employees and volunteers, therefore those individuals who are associated with the organization have a right to know about how their funds are being allocated and what types of policies are in place to determine that expectations are being met. According to a study done by the Ethical Resource Center which performed an inside view into the nonprofit sector, conduct that breaches the law or an institution's standard has increased over the years and in 2007 it reached levels similar to that of government and business organizations. Financial fraud is also now highest among nonprofits exceeding the for profit sector and corruption levels are most evidently seen amongst the board members of these organizations (Ethics Resource Centers National Nonprofit Ethics Survey). Board members are an influential aspect of the organization's success because they essentially set the tone for many of the employees of these nonprofits who consider their board of directors top management. However, it is reported that about 18 percent of employees whose board is top management are less likely to report strong ethical leadership and more likely to report misconduct over those whose top management is either a president or CEO (Ethics Resource Center's National Nonprofit Ethics Survey). This can be due to a variety of reasons, yet it is important to note that in order to be on a board of a nonprofit the IRS does not currently have guidelines in place which lay out specifics for who is certified to be on a board (McRay, 2021). Subsequently, it is mainly up to the nonprofit organization to elect individuals who best suit their foundation's mission and conceivably have some prior experience in management so that when issues arise, those on the board are better prepared to advise and guide an organization in the

right direction. To assume however, that these nonprofit organizations–-particularly those that are abundant in membership enrollments, volunteers and capital from public donations—are going to make the best decisions in the interest of the organization's mission is a bit naive if the government is not exactly enforcing much oversight or provisions over an important layer of influence.

Other characteristics which lead to a lack of ethical accountability in the nonprofit sector is the lack of strategic management and regulation especially as the sector is growing. Nonprofits are not currently subject to much of the legislation and regulation that the private sector has had to abide by such as the Sarbanes-Oxley Act of 2002 and SEC and NASD regulations (Ethics Resource Center's National Nonprofit Ethics Survey). Consequently, this has been the topic of scrutiny as these institutions receive substantial public subsidies and play a critical role in servicing the public as the government moves increasingly towards contracted services in nonprofit agencies (Deborah L. Rhode & Amanda K. Packel, 2009). The literature also cites a need for a knowledgeable strategy when approaching beauractric goals and measures of progress, which many nonprofits are surprisingly in absence of. According to Rhode & Packel many [nonprofits] use a "spray and pray" strategy, distributing aid across several programs in the hopes that something good will emerge. Unfortunately, this is not a constructive nor cost-effective use of an organization's resources, which should always be focused on the people they serve. Furthermore, there is a lack of established norms that aid in the establishment of standards and the projection of a moral public image, both of which are vital in preventing wrongdoing and maintaining the institution's virtues. "Only one third of employees considered that their workplace had a well-executed ethics and compliance program," according to a study of nonprofit organizations. This is due to regulations which have been made either too restricted, rigid or unclear. Rhode and Packel go further by stating that "only about half of nonprofit organizations have conflict of interest policies, and fewer than one third require disclosure of potentially conflicting financial interests". A similar challenge is compliance programs that solely focus on punishing violations of clear rules; an approach that has proven to be less effective in fostering ethical conduct than those that encourage self-governance and commitment to ethical objectives. This results in the further silencing of employees within these nonprofits because it is either often not in their best interest to speak up or they are afraid of retaliation against them and any of their future endeavors.

The sector also contributes to an absence of information on all of the wrongdoing occurring in nonprofit organizations and investigations are often kept private while disputes are settled behind closed doors (Fremont-Smith & Kosaras 2003). The public is generally left out of the ordeal and it can be consequential for the way in which the organization is managed going further especially if the ramifications are considered minimal to the nonprofits affluence. This further adds to the level of mistrust that has plagued the nonprofit sector over the years as less people seem disposed to becoming a part of and contributing to such organizations. Accepting funds which directly contradict the organizations motives has also been recognized as a growing problem which illustrates once again the lack of morals and consensus over the type of honesty that such institutions have to maintain in order to succeed in their underlying initiatives.

Methodology

My research is essentially conducting an in-depth view into the manners in which ethicality and accountability through an organization's code of standards, specifically in the nonprofit sector, have been inefficient using an analysis of different case studies and theoretical research which illustrate how poor leadership from top management, a deficiency of organized principles and a lack of proper regulations and coverage over this corruption affects the non profit institution's success and credibility with the public or population it means to serve. A good majority of the literature I was able to find on this topic that scholars provided as evidence of the nonprofit sector's malpractice over the years included a combination of theoretical research and case studies to present their findings. Thus, I believe that the best method of research for this particular thesis is one of qualitative analysis as it allows for the reader to consider the ideas and theories surrounding the subject matter rather than the technical and scientific characteristics. Additionally, my assessment has been that my question of interest is one of institutional concern which is looking to understand patterns and trends amongst government and bureaucratic systems within this sector of business. The literature has suggested that governments and organizations could supply some information on my research question through the investigation of data and documents already collected that demonstrate the factors that have led to widespread misconduct in nonprofit organizations. Moreover, there is information also available in a variety of articles and journals which have previously addressed the issue of wrongdoing in the nonprofit sector and its effects on the institution itself and the overall image of the sector. The cases I chose to study were selected in order to limit the scope of my research to then draw a comprehensive, but perceptive conclusion about the relation between ethical principles within nonprofit organizations and their influence on fraudulent behavior and accountability.

Nonprofit Organizations

The nonprofit sector has approximately twenty-seven distinct types of nonprofit organizations in which an individual or a group of people can register under. Each category has its own set of rules for admissibility, tax deducted contributions, lobbying and campaigning. In addition, the sector is constantly in a state of change and growth, thus for the purpose of this analysis it is necessary to be explicit about the criteria for selecting the organizations I did from the different types of subgroups within the field. The exploration of this research will focus distinctly on nonprofit organizations that are considered 501(c)(3) organizations which are most commonly known as public charities that operate for different purposes including: charity, religion, education, science, literacy, human/health services, public safety testing and the prevention of social drawbacks such as domestic violence, child abuse or homelessness (Charities and nonprofits). 501(c)3 organizations are also the most familiar type of nonprofit and typically the kind of organizations that the general public is most known to volunteer for, contribute to and hear about through the media. Not to mention that according to a study executed by the National Center for Charitable Statistics "public charities are the largest category of the more than 30 types of tax-exempt nonprofit organizations defined by the Internal Revenue Code.... In 2016, about 1.08 million organizations were classified as public charities, composing about two-thirds of all registered nonprofits. Between 2006 and 2016, the number of public charities grew 19.6

percent faster than the growth of all registered nonprofits (4.5 percent). Consequently, public charities made up a larger share of the nonprofit sector in 2015 than in 2005." Further, the organizations I will be studying more closely are all registered in the United States and deal largely with the health and human services subdivision of public charities. These four organizations that I will be analyzing in depthly to reinforce my claims include: The American Red Cross, The Cancer Fund of America Inc, Goodwill Industries International Inc. and The Bill and Melinda Gates Foundation. These big corporations were selected for analysis over local organizations because typically a much smaller nonprofit will not have enough funding or social capital to commit the kinds of broad scale corrupt behavior that is seen in much larger nonprofit organizations. This is typically because they are dealing with more money, volunteers and chapters which makes the task of managing organizational structures and principles that much harder, leaving room for ethical misconduct to run rampant. Additionally, I wanted to provide some external policy recommendations that I argue are needed to improve internal ethical processes and which are currently absent or weak due to the government's liberal approach to the sector. Analyzing large nonprofit organizations is best for this because when they participate in unethical behavior such as the mismanagement of funds or a conflict of interest, it tends to hurt a wider portion of the population than that of much smaller organizations. It also threatens the public's perception of the sector as a whole making it more difficult for smaller nonprofits, who have often found better success in meeting their organizations intended mission, from acquiring the type of funding and resources they need to make a larger and more meaningful impact on their communities. This serves as a rough guideline for the remainder of the paper in which I will use my findings to support the theory that a rigorous enforcement, existence and regard for ethical principles and standards within nonprofit organizations is instrumental in the abstinence of potential corruption and in the ability to hold its leaders and members accountable to the comprehensive objective of the nonprofit. When a nonprofit fails to have a method for ethical administration, the sustainability and success of that organization is at risk.

Some of the limitations that challenge this thesis in terms of its methodological approach is that the amount of information readily available and accessible to the public varies as organizations often do not wish to disclose knowledge that might negatively impact their reputation or tax-exempt status. My research indicates that while the business sector has experienced interest in the examination of fraud through empirical research, the same cannot exactly be said for nonprofit organizations and much of the information that is gathered about particular nonprofit organizations which have been implicated in corruptive activities can be found in newspaper reports or articles which may or may not always provide the full picture and/or present certain biases. However, this is not to say that observations and reports are completely unavailable to the researcher who wishes to further analyze previous findings, as seen in some of the studies described in the literature review which used surveys to examine nonprofit ethics, in order to add to existing research and hopefully produce more inquisitions into the subject.

Definitions

For the scope of this thesis I will be defining a few terms that have been found in my research in order to further codify and demonstrate how these organizations apply to these definitions and why they are relevant to my research question and collective theory. According to the West's Encyclopedia of American Law the definition of a nonprofit organization is stated as "a corporation or an association that conducts business for the benefit of the general public without shareholders and without a profit motive." It goes further by characterizing the difference between nonprofit corporations and profit-driven corporations by disclosing that, "the most basic difference is that nonprofit corporations cannot operate for profit. Thus, they cannot distribute corporate income to shareholders." Nonprofit corporations must keep the funds they raise in their corporate accounts to pay for appropriate salaries, costs, and corporate activities. A firm is considered profit-driven if its income harms the personal advantage of any individual. Salaries are not considered personal benefits because they are required for business operations; however, a high compensation may result in a company losing its nonprofit status. Nonprofit corporations are likewise exempt from the same income taxes as regular businesses, but only if they operate solely for the benefit of the general public (West's Encyclopedia of American Law, 2008). In order to assess why nonprofit organizations are particularly vulnerable to exploitation and thus require a uniquely effective set of ethical principles and organizational structure, the characteristics surrounding the definition of what makes up a nonprofit are important. The term corruption, as scholars have defined it, will be identified as "dishonest or illegal behavior, especially, but not entirely by powerful people (such as government officials or police officers)" (Corruption definition & meaning). Ethics and its terminology is used throughout this thesis, thereby the denotation of the term is warranted. Merriam Webster's Dictionary definition of ethics will be used and is stated as, "the principles of conduct governing an individual or a group". Fraud will be defined as any act, remark, omission, or concealment intended to deceive someone to their detriment. While there are various types of fraud, nonprofits tend to experience a particular kind known as occupational fraud. Occupational fraud generally refers to fraud committed by an organization's employees for personal enrichment through the improper use of the organization's resources and assets (J. T. Wells, 2005). This type of fraud can also be further divided into two major categories: fraud against the organization and fraud by the organization against its owners, stakeholders, community or members. Conclusively, accountability will be defined in the context of business as " an acceptance of responsibility for honest and ethical conduct towards others" (Kenton, 2022). A nonprofit organization's obligation in the business sector extends to its shareholders, employees, and the larger community in which it operates. In a broader sense, responsibility entails a willingness to be held accountable for one's actions. There are several tools a nonprofit can use, both internally and externally, to demonstrate accountability. These include, but are not limited to the disclosure of financial statements, ethical bylaws, audit reports and evaluations.

Case Studies

The American Red Cross is a non-profit organization that is funded entirely by public donations and volunteerism. Its objective, as stated under its website's "Mission and Values" tab, is essentially to "aid disaster victims and help people prevent, prepare for, and respond

to emergencies." The ARC responds to more than 70,000 disasters every year on average. In addition, it is also the country's largest blood collecting organization, giving over 40% of all blood products (American Red Cross). In terms of emergency response and blood donations, the American Red Cross has made a tremendous contribution. The organizational structure of the ARC today consists of roughly 500,000 volunteers and 35,000 employees with approximately 700 local chapters all across the country. Its operations are overseen by a board of governors and the board consists of 12–20 members, including the chair, who is selected and authorized by the United States President. Additionally the board is given the duty of appointing a president and CEO to manage the business activities of the Red Cross. While the importance of the ARC cannot be understated, the organization's reputation and overall credibility has experienced an increase in criticism in recent years as it has failed to meet its intended mission in various cases and has been discovered to have participated in unethical behavior in a variation of forms. The organization maintains a Code of Business Ethics and Conduct which can be found on their website; the document provides a twenty one page description detailing the responsibilities, behavior and practices that all employees and volunteers are expected to follow. Nevertheless, the ARC has still fallen vulnerable to corruption and other ambiguous immoral behavior; for instance, in 2011 after an investigation conducted by NPR, it was discovered that nearly half a billion dollars had "disappeared" after the organization had collected millions of dollars in donations following the 2010 earthquake in Haiti that left the country in desperate need of emergency relief. The donations were expected to be used to rebuild new roads, schools and homes for the Haitain people, yet nearly five years after the earthquake, Haiti remains one of the poorest and least developed countries with arguably some of the worst infrastructure in the world (Sullivan, 2015). This sizable mismanagement of funds prompted a deeper investigation into the organization's administration. What was found was that many of their relief projects were absent of a clear goal, disorganized, ignored or went unsupported by top leadership. Information obtained from the charity's own internal documents have helped to shed some light on these issues by looking at one particular housing project in the town of Campeche. Here the organization's written plan was to build 700 new homes because many of the people in this town were living in shacks with horrible plumbing systems. However, internal emails suggest that a number of personnel changes, long bureaucratic delays and a full year of standstill were to blame for the unaccountability of funds and uncorroborated claims that the ARC's goals to build these homes were being met. One specific email layed out how "there were multiple warnings about internal delays clogging up efforts to get projects off the ground. Frustrated managers in Haiti wrote notes to supervisors waiting for approvals from headquarters" (Sullivan, 2015). In an interview with Lee Malany–who lead the Red Cross' shelter program in Haiti beginning in 2010—he states that on a trip to headquarters in D.C. to meet with top leadership to discuss these obstacles, he found that senior officials were incredibly lost on how to allocate millions of dollars set aside for these types of housing projects accruing in towns like Campeche. Moreover, there seemed to be more concern about maintaining public relations relating to this problem, particularly from one critical figure, the CEO of the organization, Gail McGovern. She writes in one email, "We still are holding $20 million of contingency. Any ideas on how to spend the rest of this? (Besides the wonderful helicopter idea?) Can we fund Conrad's hospital? Or more to [Partners in Health]? Any more shelter projects?" (Elliott, 2015). A CEO's job, particularly in a nonprofit organization, is to set the highest ethical standards not only for themselves, but for their board members, stakeholders, employees, volunteers and the general public.

Judging from these emails it is clear that if ethical principles are not applied from the very top of the chain of commandment within your nonprofit organization this can then have a negative impact on if, how, and when your goals get accomplished. Although the Red Cross does provide written proof of a code of ethics and conduct, whether they actively adhere to these standards in order to try to evade corruption as much as possible is doubtful. As mentioned previously in the literature, an organization's leadership, notably its executive director, has a distinct vested duty to support the work of their committee's and ensure that their board members are performing according to its stated purpose. Thus, when someone like McGovern clearly fails to do this, you get results like the kind we have seen in Haiti, where the people who these organizations are supposed to be helping receive almost nothing in relief.

The Cancer Fund of America Inc is another nonprofit organization that has experienced serious egregious misconduct since its inception in the early 1980's. The organization was established by a man named Jim Reynolds Sr. who in fact had years of previous experience working for nonprofit organizations, particularly the American Cancer Society, which has remained widely respected to this day. Reynolds was ultimately let go however, from his position at the American Cancer Society, for what they cited as "sloppy-record keeping" and the misuse of company assets/donations. Shortly after this dismissal he established his own cancer charity, the Cancer Fund of America Inc., which states that its mission is to, "provide support and services to financially indigent patients; to disseminate information concerning the early detection and prevention of cancer; to provide commodities, and gifts-in-kind to hospices and other health care providers; finally, to procure and distribute donated merchandise to various 501-(c)-(3) nonprofit community service organizations which aid the ill, needy, and infants" (Jones, 2015). An investigation conducted by the Federal Trade Commission as recently as 2015 alleged however, that for the past few decades the organization had been conducting itself as a charity mainly just in name because it had been discovered that it was failing incredulously to meet the objectives that its mission statement had purportedly set out. An article written by The Atlantic declared that the FTC found that over $100 million dollars in public donations had been redirected to pay for "posh jobs for family and friends, jet-ski trips, college tuitions and other luxury goods" (Graham, 2015). Instead of hiring people with administrative experience and a genuine passion for charitable causes, Reynolds opted to employ many of his family members, giving them positions of high office and unreasonably excessive compensations that often did not reflect the work. This indicates, once again, that when there are no clear principles established by government controls like the IRS, in selecting members of a board of a nonprofit, the assumption that founders and executives will select the most qualified people, is flawed. One of the appeals of these kinds of organizations, whether it's expressed or not, is the tax exempt status that is enjoyed as a 501(c)3. Thus, it is not entirely wrong to assume that certain people in society would look to take advantage of this under the disguise of virtuous intentions. To add to these miscarriages, from the reasearch I was able to conduct it did not appear that the Cancer Fund of America had any history of a code of ethics and conduct—contrary to the ARC–-that illustrates the organizations principles and values. The implications of this are made apparent, for instance, in the way that employees were allowed to use corporate credit cards to make a slew of purchases unrelated to the direct aid of cancer patients and research or in the way that the organization solicited donations through telemarketing schemes (Martin , 2015). Of all the money that the

organization raised in the time that it was active, less than three percent actually made its way to these cancer patients it supposedly intended to help. This is clearly in contradiction to what defines a nonprofit as stated in the methodology section of this thesis. When a nonprofit seizes to operate solely for the benefit of the general public it is no longer a nonprofit, but rather an organization looking to take advantage of flawed and tenuous ethical standards existing in the philanthropic sector. Conclusively, prior to the 2015 inquiries, the CFA had had several confrontations with state regulators and consumer watchdogs, generally about their questionable fundraising schemes and yet not much had been done to stop them from continuing their unethical practices. Which brings into question just how these nonprofit organizations are expected to be held accountable to their board's mission if the people that should be investigating and addressing these concerns when they arise are practically disregarding them?

Goodwill Industries International Inc. is a widely recognized nonprofit organization across North America. The thrift store giant has operated since 1902 and one of the unique ways it fundraises for its cause, besides direct monetary donations from the public, is by selling free goods at a profit to help fund job related programs and people with disabilities. Currently it oversees 164 regional Goodwill organizations and 3,200 individual stores. It is an organization which was reported to generate a total of approximately six billion dollars in revenue at the end of 2020 which is considerably a large amount of capital (Goodwill Industries International). According to their website their universal mission states, "Goodwill works to enhance the dignity and quality of life of individuals and families by strengthening communities, eliminating barriers to opportunity, and helping people in need reach their full potential through learning and the power of work". The organization also provides a code of ethics policy statement, however, it is not specifically listed on their website; if someone wishes to obtain a copy they would need to search for it online. This makes it a bit more difficult for the public to have easy and transparent access to such information through one of the organization's most important marketing tools; their own website. In this policy statement some of the principles that it states the company upholds include; holding people accountable for their work performance and conformance to the Code of Ethics, honesty, individual responsibility, respect and making commitments that can actually be accomplished. Nonetheless, the organization has come under scrutiny over its suspicious business practices and lack of corporate oversight. Ruth McCambridge investigates a recent World-Herald report by Henry Cordes in a 2016 essay for Nonprofit Quarterly, which described some unsettling information Cordes unearthed inside Goodwill financial papers he secured under the Freedom Of Information Act. What was found was that nearly all job training and assistance programs were being funded by governmental contracts and grants at stores specifically in the state of Nebraska. This funding was in place of the four million dollars in yearly profits that the stores reportedly generated and when it came down to it, officials were only able to account for half a million dollars in jobs program spending that came directly from retail sales. Moreover, administrative overhead costs are a majority of what is eating up store profits, distinctly when the organization's top leaders are being paid upwards of $700,000 annually (Minium A., 2021). Impulsively high compensations for top leadership are characteristically egregious in the case of Goodwill because not only do they hire disabled workers, but they take advantage of a specific law under Section 14(c) of the Fair Labor Standards Act that allows them to pay these workers cents on the dollar due to outdated ancient conditions. This is clearly in contradiction with their described

goals and values, not to mention outright immoral to abuse people with any sort of medical or psychological disability. Furthermore, the organization has been accused of unsafe work environments and safety practices that have actually resulted in various deaths, majority of which have been people with disabilities. One article found that an employee who had raised concerns to his supervisors over safety measures—weeks before a 26 year old man was killed on the job—had been fired after taking time off to deal with the trauma of witnessing such a tragedy. This same employee had even gone as far as to type up an official memo that specifically laid out the problem and potential solutions to his managers, prior to the incident (Why goodwill goes bad). Still, Goodwill chose to retaliate against the employee in fear that this employee would speak out and also to cover up their own internal failures. To demonstrate one's point, in the company's code of ethics policy statement it clearly states under "General Guidelines", quote "any employee who is aware of, perceives, or observes any violation of our Code of Ethics is encouraged to report the violation to his/her supervisor, Department Head, Human Resources Manager, or Corporate Compliance Officer. Failure to report such a violation may result in corrective action up to and including termination of employment" (Code of Ethics Policy Statement). This particular employee clearly abided by these general guidelines by actively attempting to warn upper officials of the problems they were noticing and yet they still got terminated. Thus, it can be determined that this type of decision is likely to stifle others who may wish to come forward in the future about administrative and ethical misconduct occurring within these organizations, because one's job could be at risk. Ultimately, this can create a toxic environment that undermines the reputation of an organization and its ability to clearly conduct moral charitable efforts.

The Bill and Melinda Gates Foundation was founded by none other than the Microsoft CEO himself and his wife in 2000 to target global health, US education and third world development. The organization's objectives as stated in their website is to essentially, "create a world where every person has the opportunity to live a healthy, productive life" (Bill & Melinda Gates Foundation). It also provides a thorough documentation of the types of ethical principles and values the foundation has chosen to adopt. Over the years the organization has grown rapidly, specifically in funding, likely due to the kinds of unique access that the foundation has to some of the richest people in the world. Such people like Warren Buffet for instance, who in 2006 "pledged $31 billion in company stock to the Bill and Melinda Gates Foundation" (McGoey , 2015). Normally this level of excess in capital is not typically seen in your average 501(c)3 nonprofit, however, this is precisely why a thorough analysis of how the organization operates is warranted when much of their fundraising, similar to Goodwill, comes from grants or direct charitable contracts. In addition, this nonprofit organization presents a separate inquiry, that hasn't really been touched on in the previous case studies, about the morality and role of billionaires, such as Bill Gates, in the philanthropic sector. Some public health critics have expressed their concern over what they believe are competing interests and potential abuses of power within the foundation's apparently altruistic efforts to meet their intended purpose. Typically, when an organization files for 501(c)3 status, it needs to meet certain requirements and once it has, it can be established and exercise its tax exempt free status. Still, some regulation created by the Internal Revenue Service will need to be adhered to in order to maintain this kind of status annually. One of the provisions that the IRS has placed on nonprofit organizations is their ability to lobby. On their website it clearly states that, "in general, no organization may qualify for section 501(c)(3) status if a substantial part of its activities is attempting to

influence legislation (commonly known as lobbying). A 501(c)(3) organization may engage in some lobbying, but too much lobbying activity risks loss of tax-exempt status" (Lobbying). What constitutes "too much lobbying" is evidently unclear and subject to individual interpretation. This is partially how the Bill and Melinda Gates Foundation has managed to tiptoe around this sort of arrangement. The organization spends about three billion, of its forty two billion endowment, each year on causes and projects that on face value seem impeccable. However, in 2013 it was reported that "the Gates Foundation gave over $300 million to the UN health agency — the largest contribution from any donor that year, including the US government. What the Gates Foundation spends on global development yearly is almost as much as the overall operating budget of the WHO", meaning that while this is only a small fraction of the organization's overall funding budget, it obviously still holds a ton of weight in terms of influencing global health policy (McGoey , 2015). In addition to bending the technical meaning of certain principles, the Gates foundation has also been accused of contributing to the exact kinds of issues that it is intending to prevent. Increasingly, it has sought to make donations to for-profit corporations, such as those in the fossil fuels industry, that often conflict with the general interests of the organization's goals. The foundation tends to have active investments in these businesses meaning that it is profiting from its own donations given to these corporations which then leads to social and economic injustice. In an article published by the Guardian in 2015, it was revealed that the charity "held at least $1.4bn (£1bn) of investments in the world's biggest fossil fuel companies", even though it has long said that climate change is a serious threat that requires immediate action (Revealed: Gates Foundation's $1.4bn in fossil fuel investments, 2015). In essence, the Gates Foundation has demonstrated that although it has maintained a legible code of ethical conduct, it has explicitly strayed from following the same rules that many much smaller nonprofits normally have to abide by. This can be seen through the revelation of their large donations to for-profit corporations that often conflict with their internal and external interests. Or in the organization's arguably influential lobbying efforts that it continues to insist it is not participating in.

Conclusion

Through the extensive analysis of four separate non-profit organizations, The American Red Cross, The Cancer Fund of America Inc., Goodwill Industries Inc. and the Bill and Melinda Gates foundation, this thesis set out to to examine a vital subject in the area and build on some of the previous findings, which imply that a lack of understanding, importance and existence for ethical rules in the philanthropic sector has a direct impact on the legitimacy and efficacy of charities in achieving their goals. As some of the literature found, the philanthropic sector has grown dramatically in the past few decades and with this growth has come an increase in unethical misconduct as much of the sector has been left to decide for themselves what types of principles and values they wish to independently adopt within their nonprofit organizations. This external government approach towards non profits has frequently led to internal structural process complications. What has been assessed through my examination of these foundations in particular, is that each of them share many of the same characteristics in terms of the ethical wrongdoing that the literature previously suggested typically permeates this sector such as, an egregious mismanagement of funds, organizational/managerial structure issues, conflicts of interest, whistleblowing preservation and a disregard or ignorant attitude towards ethical codes. Although all, but one organization

provided a code of ethics which could be obtained through either their website or a search on the internet; still it remained apparent that much of the ethical guidelines written in these manuals persisted as just that because there were several examples in which these principles were not actively being practiced. Additionally, leadership at the top of many of these organizations continuously set precedent of ethical wrongdoing through attempts to disguise financial statement disclosures illustrating the misallocation of millions of dollars within these organizations. Which sets up another obstacle that in particular many of these large organizations which have established well known reputations and a steady influx of public donations and volunteerism face. This barrier suggests an excess in funding can potentially be detrimental to an organization's ability or know-how to ethically allocate such sizable quantities of money. One instance of this is illustrated in the assessment over The American Red Cross organization and its CEO's blatant admittance to wanting to give away free money because the nonprofit was unsure of where to spend it. The temptation to commit fraud is much greater within these kinds of nonprofits because they receive so much money that it is easy to assume that no one will notice if a couple hundred million dollars goes unaccounted for when the sector currently generates billions of dollars in revenue annually. It also helps that in many cases, such as the one seen in the case of the Cancer Fund Of America, executive directors similar to Jim Reynolds Sr. often go uscathed by the consequences of their actions because accountability is generally really low and oftentimes people are not required to provide restitution for their misconduct. This further destabilizes the sector because it is basically assumed that wrongdoing is sure to repeat itself, especially when it has been made clear that there will be no ramifications for such behavior. This is both an internal and external observation of the issue. My findings also raised questions about a particular kind of ethicality that often goes unnoticed in this sector of business which is the potentially direct influence these organizations can often have on lobbying efforts and policy making as seen in the case of the Gates Foundation. There is concern growing over the light verbiage and standards with which 501(c)3 organizations are informally expected to abide by. As has been gathered through my results, most nonprofit organizations adopt a generally universal code of ethical principles, however, how well or how much these code of ethics are able to curb corruption and increase accountability varies among different nonprofits. Conclusively, the results in particular to these four nonprofit organizations suggest that the code of ethics each adopted, for the most part did very little to assure that members, stakeholders, executive directors, employees and volunteers do not engage in unethical malpractices.

This leads into the kinds of external policies that I propose need to be implemented on a wider scale to help ensure that internal policies are actually being upheld for the purpose of achieving the nonprofits overall mission; which is primarily to help fill gaps in the community that it promises to serve. One of the policies that the government could implement first and foremost is a legal obligation to disclose specific details about program spending and monetary allocation. Currently, nonprofits are not exactly forced to reveal to the public or even state regulators—unless specifically requested—intricate details regarding project or administrative spending. By creating a policy where nonprofits would be obligated to report this kind of information, both the public and the government could get a better idea of where exactly money is being spent and how effective this money has actually been in creating visibly efficient change. It could also then conclude whether or not the nonprofit is doing everything it can to make sure that money is being used in the most

appropriate way so as to determine if tax-exempt status should remain. Another policy that would benefit the sector is added rigorous investment policies that do not conflict with the unique nature of nonprofit organizations. A nonprofit should not be allowed to make investments in disguise of "donations" to for-profit companies that categorically undermine the goals of the organization. And yet, this is exactly what is increasingly occurring because there are no legal protections currently stopping such entities from doing so. Moreover, sometimes nonprofits go even further in the act of ethical wrongdoing, by donating to large for-profit corporations that they are also actively invested in, meaning that they can then make a significant profit off such endeavors. All of which clearly goes against what nonprofit organizations were intended to do, which was originally to act independent of the government for the purpose of fulfilling problems in the community through collaboration, that may have otherwise gone unaddressed by the government because there is a plethora of social, political and economic issues in the world. Although there is still so much to be addressed in the sector in terms of ethical accountability and the study of misconduct within these organizations, by providing further analysis into these four nonprofits, this thesis concludes that there is potential for a restructuring of current models with the help of external policy adjustments, to help restore confidence in the public and in the sector, that nonprofits are beneficial to our communities and society as a whole.

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Efficiency of the Simplex Algorithm: the Assignment Problem Case

Dr. Switkes

Abstract

Operations research (O.R.) is an interdisciplinary field that has become part of the larger umbrella of analytics. An algorithm often used in O.R. to solve Linear Programming Problems (LPs) is the Simplex Algorithm, developed in 1947 by mathematician George Dantzig, which provides optimal solutions for LPs. Although Dantzig proved Simplex was finite, its efficiency was questioned. Previous research exploring its efficiency has shown that problems can be carefully constructed to point Simplex towards a longer path (number of iterations) that results in behavior that is exponential in the size of the problem.
Our goal is to analyze the behavior of Simplex when applied to Assignment problems. Does it follow nice behavior that is linear in the size of the problem or does it behave differently? The unique structure of Assignment problems allows us to explore the theoretical conversation of problem construction and modifications to Simplex. To set the groundwork for our analysis we use MATLAB's Optimization toolbox to solve randomly generated Assignment problems of different dimensions. We then use MATLAB to extract the number of iterations Simplex takes to solve a problem and perform statistical analysis that reports the average number of iterations. We then consider constructing Assignments Problems with objective functions coefficients that are sufficiently spread out for dimensions n=2 and n=3, and we also solve the permutations of these coefficients. Our analysis can then be used to guide theoretical conversations on efficiency. Here we will present preliminary results of our data and statistical analysis on Assignment Problems.

Introduction

Background

Operations research, often referred to as O.R., is an interdisciplinary field that has grown and become a part of the larger umbrella of analytics. The field has gained popularity with its tools to solve stan- dard and non-standard LPs. An algorithm often used in O.R. to solve LPs is the Simplex Algorithm, developed in 1947 by mathematician George Dantzig to provide optimal solutions for various types of linear programming problems using a linear algebra foundation.

At the time of the development of Simplex, many researchers were satisfied with a proof that it was a finite algorithm [Sha87] while others questioned its efficiency [LO᷈84]. There has been research involving many real world and randomly generated problems that have explored the efficiency [Sha87] of the Simplex Algorithm. However there is very little to no research that has specifically considered the efficiency of the Simplex Algorithm when applied to Assignment problems.

Previous Work

Through Ron Shamir's work on the "Efficiency of the Simplex Method: a Survey" [Sha87] from 1987 we explore the efficiency of Simplex from many perspectives. Shamir presents 2miterations folklore. The 2miteration folklore came from Dantzig's 1963 book where he states that, For an m-constrain problem the number of iterations may run anywhere from m as a minimum, to 2m and rarely to 3m. [Sha87], however there is no proof to Dantzig's cautious words. Through Shamir's survey we learn about problems that support the 2m folklore and problems that don't, labeled bad experiences. In 1980 Norman Zadeh suggested the creation of a rule to bring the least entered variable into the basis to kill the exponential behavior in worst case scenario LPs [Zad80]. Recently S. Kim and J. Switkes [KS08] made an observation on the distribution on the length of the path taken by the Simplex al- gorithm when applied to problems with 100 decision variables and 100 constraints. Additionally S. Kim and J. Switkes ensured the origin would not be considered as an optimal solution, with these constraints on their simulations S. Kim and J. Switkes' data yielded a mean number of iterations to be 7.0981, which agrees with Dantzig's statement as 7 iterations is significantly less than 100. [KS08].

However, Kitahara and Mizuno recently proved there exists such an LP, a variant of Klee and Minty's LP, designed to take $2m - 1$ iterations, where each iteration shows an improvement of 1 [KM11]. This carefully designed LP proves that Simplex can follow an exponential path to optimality rather than linear in the size of the problem.

While the experiments and observations include both Simplex and researchers' own variants of Simplex we note that there is a lack of studies on Assignment problems. However a 1981 study by Lindberg andOlafsson,"OntheLengthofSimplexPaths:TheAssignmentCase"[LÓ 84] donewithastochastic variant of the simplex method addresses assignment problems [LÓ 84]. In their research they consider objective functions with significantly spread out coefficients. The Simplex Algorithm is a great method to solve LPs in O.R. However not much has been explored about the optimality of the path it takes in consideration to Assignment problems. Are there cases in which Assignment LPs follow a non-linear path to optimality?

Research Statement

While Dantzig proved the Simplex Algorithm was finite we were left to explore its efficiency. Over the past 50+ years mathematicians have explored different properties of LPs to investigate how their construction can influence the path taken by the Simplex Algorithm. Some mathematicians believe that with a fixed number of variables n, the number of iterations taken by the Simplex Algorithm grows proportionally to the number of constraints m. While others like Ho and Loute believe that problems with dimensions in the thousands indicate that the number of variables influences the number of iterations [Sha87]. In our literature review we have come across little information on the efficiency of the Simplex Al- gorithm when applied to Assignment Problems which are particularly interesting for their unique structure and binary coefficients. In our research we investigate whether Assignment Problems follow a simplex path with linear or nonlinear behavior.

Methods

The following provides the reader with a high level overview of how the Simplex Method works. The Simplex Algorithm starts at the origin, if it is a feasible point, of the LP. It then goes about the LP's constraint boundaries in the direction of the most rapid improvement for our objective function Z.
Simplex will then walk from a Corner Point Feasible (CPF) solution – the intersection between constraint boundaries – to the next CPF solution iteratively.
Simplex will stop when there are no further improvements in our LP objective function.

Assignment Problems

Assignment Problems: These problems are a special type of Transportation problem that consist of assignees, i.e., sources being assigned to perform a task i.e., a destination. It is important to note that for assignment problems the number of assignees must equal the number of tasks, therefore when we refer to dimension this is equal to the number assignees which is also equal to the number of tasks. Assignment problem decision variables are binary and all constraints sum up to 1 [HL15].

$$\text{Minimize } Z = \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} x_{ij}$$

$$\text{subject to} \sum_{i=1}^{n} x_{ij} = 1 \text{ for } i = 1, 2, \ldots, n$$

$$\sum_{j=1}^{n} x_{ij} = 1 \text{ for } j = 1, 2, \ldots, n$$

$$\text{and } x_{ij} \geq 0 \text{ for all } i \text{ and } j$$

where c_{ij} denotes the unit cost for source i and destination j
x_{ij} denotes the **binary decision variable**

Binary decision variable xij is assigned the value 1 if assignee i performs task j, and 0 otherwise [HL15].

Methods

To investigate the behavior of the Simplex Algorithm in regards to Assignment problems we will randomly generate problems of varying dimensions using MATLAB. We will then use MATLAB's optimization toolbox to solve the problems and record the length, the number of iterations required to solve the problem, of the path taken by Simplex. Using our results we analyze the performance of Simplex by investigating the relationship between efficiency and problem structure and properties. This allow us to further understand the efficiency of the Simplex Algorithm in regards to Assignment problems.

In our research we use MATLAB to generate random LPs, solve them, and collect data. We then use R Studio for statistical analysis such as plotting regression lines, considering the mean value for a certain dimension of the problem, and standard deviations.

To generate our assignment problems we created a function AT LP.m that took as an input a dimen- sion value n and generated an assignment problem with n2 variables and 2n equality constraints. We then used MATLAB's optimization toolbox to solve the problem by applying simplex to the dual of the problem and recorded the number of iterations taken to reach the optimal value. As a result of the unique structure of assignment problems we only need to randomly generate our objective function coefficients, which we have done using the rand function.

Our trials are generated in separate MATLAB script which use the AT LP.m function. To investigate the behavior of Simplex when applied to Assignment problems we designed four trials.

• Trial 1
Randomly generated the objective function coefficients of 1000 LPs. To ensure the randomness of our problems we used rng("shuffle"). The 1000 problems were made up of 10 problems for each dimension from 1to100 with a step size of 1, where the dimension is the number of assignees which equals the number of tasks.

• Trial 2
Randomly generated the objective function coefficients of 150 LPs. We ensured randomness of the problems as we did with the rng function.The problems were made up 5 problems for each dimension from 1to300 with a step size of 10, where the dimension is the number of assignees which equals the number of tasks. Trial 2 was designed to look at the behavior of Simplex with Assignment problems at higher dimensions.

• Trial 3
Randomly generated the objective function coefficients of 250 LPs. We ensured randomness of the problems as we did with the rng function.The problems were made up 5 problems for each dimension from 1to500 with a step size of 10, where the dimension is the number of assignees which equals the number of tasks. In Trial 3, we again explored the behavior of Simplex at higher dimensions. Another reason we chose 500 was to test the run time of MATLAB, when trying dimensions 1 – 1000 we ran into longer run times.

• Trial 4
Structure the coefficients in our objective to be powers of 10 for dimensions n = 2 and n = 3. We then solved the assignment problems created when doing the permutations of the coefficients, (n2)!, using MATLAB which took a little over 2 hours for n = 3. In this trial we aimed to understand how having significantly spread out coefficients in the objective function affects the path Simplex takes with Assignment Problems.
In future work we can expand our 4th trial by considering significantly spread out coefficients at larger dimensions such as n = 100.

Results & Analysis

After running our MATLAB script "AT LP", which can be found in the appendix, and collecting data from the different trials we decided to investigate if we could observe relationships between the number of iterations taken to solve problems and the dimension (number of assignees which is equal to the number of tasks). When we plotted our data, we immediately noticed that we had linear behavior, as the dimension increased the number of iterations taken to solve the LP increased linearly with an approximate slope of 2, for trials 1-3.

In Figure 1, we plotted the regression line for the data collected in trial 1 which had a slope of 2.08. Similarly Figure 2 and Figure 3 show the data for the second trial which had a slope of 2.125 and the third trial which had a slope of 2.16. This is particularly interesting because our number of equality constraints is 2 · (dimension) and number of variables is (dimension)2. Therefore, our results sup- port a linear relationship (approximately slope of 1) between our number of constraints and number of iterations for Assignment problems. Notice that as the dimension increases the slopes increases slightly.

In our plots we can observe that for dimension (n) versus the number of iterations is linear. These results are agree with our literature review which explore general LPs.

We considered more carefully designed objective function coefficients and hypothesized that we would get longer solving times as pointed out in our literature by Lindberg and Olafsson for other non- Assignment LPs. We developed MATLAB code, which can be found in the appendix, to solve and gather useful information for Assignment LPs whose objective function coefficients were powers of 10 allowing us to observe if having large coefficient ratios results in a longer simplex path. Additionally we also solved the permutations of the objective function coefficients which can be seen in Figures 4 and 5. These results show the percentage of problems solved in a certain number of iterations for dimensions n = 2 and n = 3, 4 decision variables and 9 decision variables respectively. From our results we observe that the worst cases in our variations for n = 2 and n = 3 are 4 and 6 iterations respectively, which support linear behavior as 4 ≤ 2 · (dimension) = constraints = 4 and 6 ≤ 2(dimension) = constraints = 6. Trial 4 yielded interesting results, for although we had the same coefficients in our objective function certain permutations led simplex to take longer paths. In particular if we consider Figure 5, we can see that for dimension n = 3, for which we have 9 decision variables, there was approximately 2.27% of 9! problems that took 6 iterations. Whereas in Figure 4 we see a different kind of distribution. A comparison between the problems that took 3 iterations versus 6 iterations when n = 3 would be future work.

Data
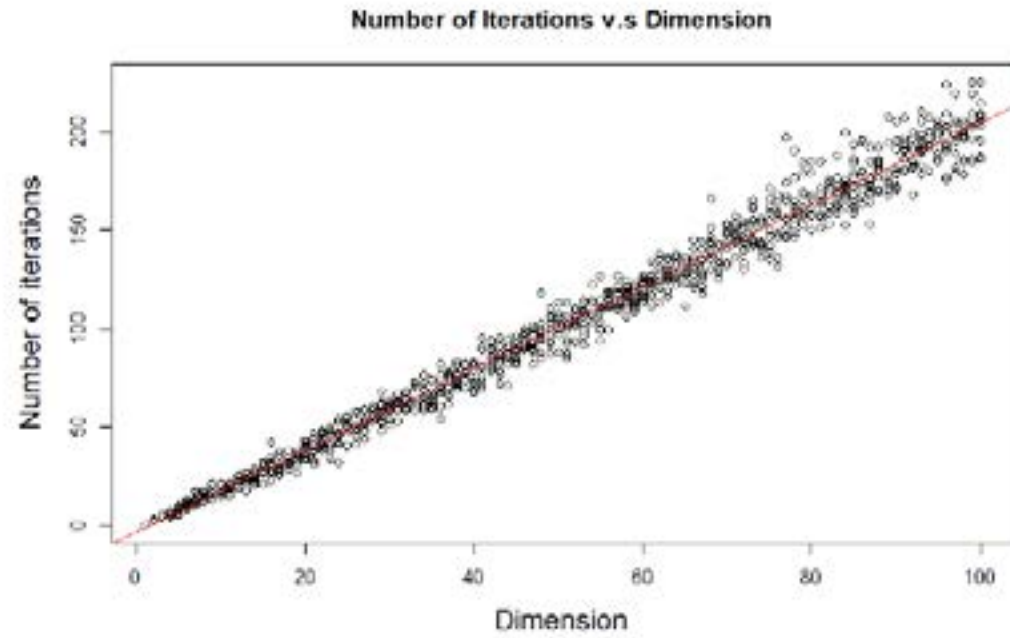
Figure 1: Trial 1: 1000 Assignment problems, 10 LPs for each dimension from 1 - 100. The number of iterations to solve the LP were recorded as well as the optimal value.

Figure 2: Trial 2: In the second trial we considered 150 LPs, 5 problems for each dimensions from 1 - 300 with a step size of 10.

Figure 3: Trial 3: In the third trial we considered 250 LPs, 5 problems for each dimension from 1 - 500 with a step size of 10.
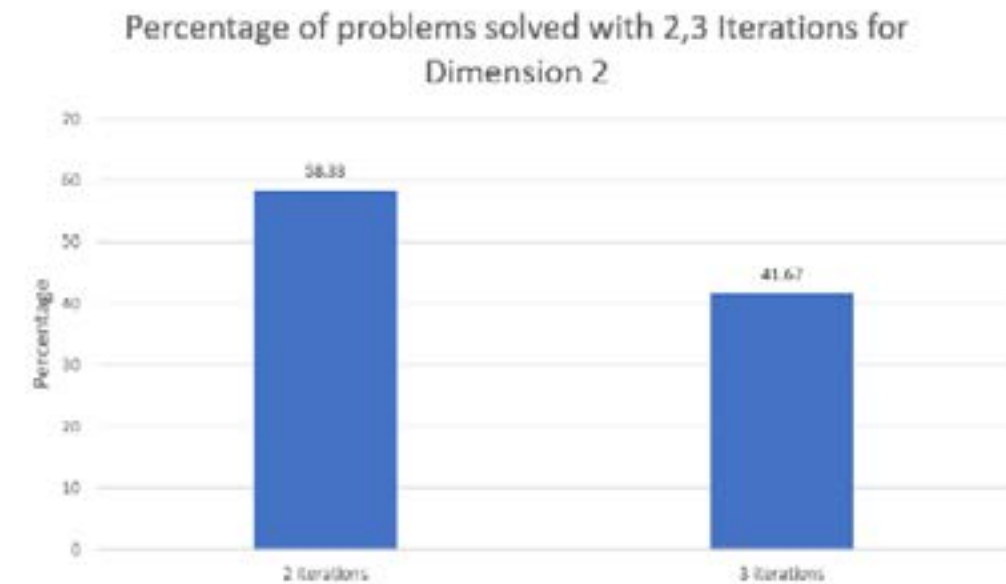
Figure 4: Trial 4: Percentage of problems solved with 2 or 4 iterations for dimension 2.

Percentage of problems solved with 3,4,5, and 6 Iterations for Dimension 3
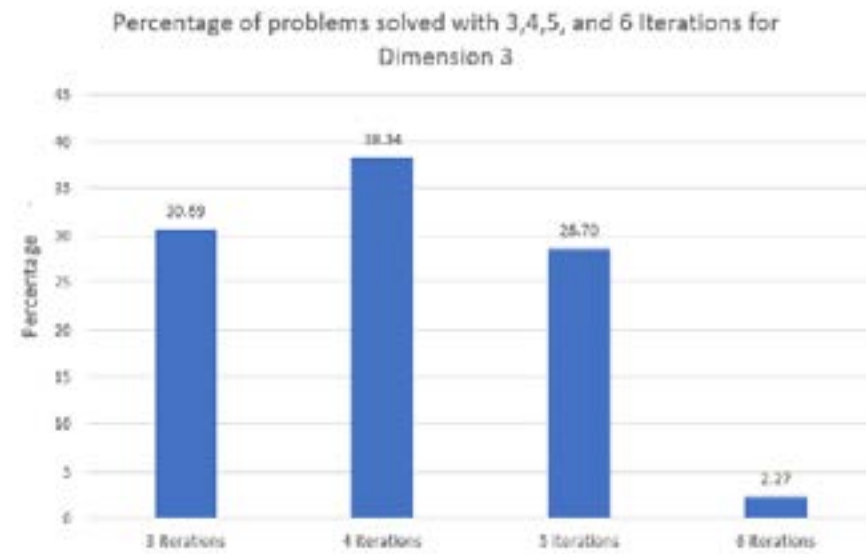
Figure 5: Trial 4: Percentage of problems solved with 3,4,5, and 6 iterations for dimension 3.

Future Work

In conclusion our work exploring the efficiency of the simplex algorithm when applied to assignment problems supports linear behaviour. Trials 1, 2, and 3 which considered randomly generated objective function coefficients for varying dimensions supports the linear relationship between the number of iterations and dimension. Trials 4 and 5 which considered an objective function with significantly spread out coefficients also seemed to support a linear relationship. In Future work we could consider looking at the objective function coefficients being significantly spread out for larger dimensions. A comparison for n = 3 of Trial 5, between the problems that took 3 iterations and those that took 6 iterations could also be interesting. Finally it would be interesting to see if we could construct an Assignment LP that has nonlinear behavior.

Appendix

Matlab Code that will randomly generate the objective function.

```
1  function [x, fval, exitflag, output, f] = AT_LP(x)
2
3  %Diana Morales and Professor Switkes || Cal Poly Pomona || dlmorales@cpp.edu
4
5  %Solving Trnasportation and Assignment Problems
6  %Given a dimension,x, this function will return the values for each variable
7  %that result in an optimal solution as well as the number of iterations
8  %taken by Simplex to solve the problem.
9
10 rng('shuffle') %look into shuffle for randi v. rand
11 %the comments include the example of x = 3
12
13 %include line to reinitialize seed val for rand.
14    n = x^2; m = 2*x; % n = 9 variables; m = 6 contraints
15    f = rand(1,n) %generate random coefficient for our objective function
16    b = ones(1,m); %generate the RHS of constraints
17    lb = zeros(n, 1); %lowerbound constraints i.e x>=0
18
19
20    %construct matrix is making matrix A
21    compose_matrix = zeros(m,n);
22    i = 1; %i is used as a counter for equn.
23    for k = 1:x:n %
24        compose_matrix(i, k:(k+x-1)) = ones(1,x);
25        i = i+1;
26    end
27
28    h = 1;
29    d = 1;
30    for h = 1:m
31        compose_matrix(h, d:x:n) = 1;
32        d = d+1;
33    end
34
35
36    [x, fval, exitflag, output] = linprog(f, [], [], compose_matrix, b, lb, [], foptions
       );
37
38    %method = output.algorithm %used to verify the method used to solve LP
39    output = output.iterations;
40    compose_matrix
41
42 end
```

Matlab Code that will take as an input the objective function coefficients.

```matlab
function [] = SpecialCase_LP(asc_vec)

%Diana Morales and Professor Switkes || Cal Poly Pomona || dlmorales@cpp.edu

%Let asc_vec be a vector with exponentially large coefficients is ascending
%rearrange these numbers. Collect the optimal values associated with each
%different ordering, comments work with example where asc_ord = [1, 10, 100, 1000]
%Function will output a csv file

%try n = 3 therefore 9!
% 10 by 10 or 20 by 20 Try manually making strategic objective functions
%

%inits
rng('shuffle') %look into shuffle for randi v. rand
all_poss = perms(asc_vec); %returns a huge matrix
dims = size(all_poss);
cols = dims(2);
rows = dims(1);

    for curr_row =  1:rows
        %curr_row
        cur_obj = all_poss(curr_row, 1:cols);

        %include line to reinitialize seed val for rand.
        n = cols; %num of variables
        m = 2*sqrt(cols); %num contraints
        b = ones(1,m); %generate the RHS of constraints
        lb = zeros(n, 1); %lowerbound constraints i.e x>=0

        %construct matrix is making matrix A
        compose_matrix = zeros(m,n);
        i = 1; %i is used as a counter for equn.
        for k = 1:sqrt(cols):n %only does the first set of contraints, hence the step
    size
            compose_matrix(i, k:(k+sqrt(cols)-1)) = ones(1,sqrt(cols));
            i = i+1;
        end

        h = i;
        d = 1;
        for h = 1:m
            compose_matrix(h, d:sqrt(cols):n) = 1;
            d = d+1;
        end

        [xopt_basis, fval_optval, exitflag_rsnforstop, output] = linprog(cur_obj, [],
    [], compose_matrix, b, lb, [], foptions);
        %method = output.algorithm %used to verify the method used to solve LP
        output_numiter = output.iterations;
        if exitflag_rsnforstop == -2 %i.e no optimal soln found
            fval_optval = -j; %for tracking purposes
            xopt_basis = -j; %for tracking purposes
        end
        compose_matrix;
        T(curr_row, :) = table(fval_optval, exitflag_rsnforstop, output_numiter);
        T1(curr_row, :) = table(cur_obj);
        T2(curr_row, :) = table(xopt_basis');
    end

    writetable(T, 'specialCase.csv')
    writetable(T1, 'specialCase_T1.csv')
    writetable(T2, 'specialCase_T2.csv')
end
```

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Nguyen   **Faculty Learning Communities (FLC): Faculty Attitudes,**
Harmony   **Experiences, and Suggestions**

Introduction

Higher education institutions have made recent efforts to utilize novel technological platforms that can support faculty and expand on new teaching and learning methods. In today's climate, faculty have to navigate and learn new technologies to accommodate students' needs. Therefore, the present study evaluated a year-long Faculty Learning Community (FLC) designed to teach faculty the best practices in video design, share on-campus resources that may assist in developing videos and how to distribute the videos to students. A group of six to twelve interdisciplinary faculty participants engaged in an active, collaborative program in which they learned technical skills, created four videos, created their own workshop and reflected upon the learning process. Participants attended bi-weekly meetings where they completed a pre and post meeting survey. In addition, participants completed a formative evaluation at the end of each semester, sharing their thoughts and perceptions of the FLC. Hence, the present study focused on examining whether an intervention, such as the Faculty Learning Community, could improve the effectiveness for virtual learning by assessing participants' engagement, perceptions and acquisition of technical skills.

Literature Review

The COVID-19 pandemic has created an increased need for FLCs as faculty search for innovative ways to teach, improve pedagogy, and create a sense of community among colleagues. Based on previous research, a successful FLC depends upon the faculty and what drives the faculty to enhance their teaching strategies. A study completed by Hou and Wilder (2015) at the University of Georgia sought to determine what motivated faculty members in an FLC to improve their strategies for creating learning environments for their students. Results demonstrated an increase in faculty interest to enhance teaching methods when they witnessed positive classroom outcomes. According to Hou and Wilder (2015), "A majority of the service-learning (SL) faculty in the study expressed an intrinsic passion for better student learning outcomes as the most important motivational factor. This was an important finding as intrinsic motivation is usually stronger, which could last longer than external incentives. Data showed that personal values guided their commitment to SL and were a strong motivating factor evident throughout responses" (Hou & Wilder, 2015). In other words, genuine interest in improving teaching strategies was the most rewarding part of the faculty's learning community, consequently improving the students' experience in the classroom.

A study conducted by Rands et al. (2017) at Iowa State University demonstrated the well-documented history of positive experiences with faculty learning communities. Since 2005, Iowa State University's faculty have participated in Team-Based Learning (TBL) and FLC, and they define an FLC as "a group of people who engage in a collective process of learning through shared experiences and practices grounded in an authentic context" (Rands et al., 2017). The FLC helped professors develop new methods, share their best practices, and engage in scholarly work while teaching and learning. Meetings were conducted twice monthly with approximately 15-20 participants from Iowa State University. Upon completing the FLC, many members agreed that the TBL framework and FLC allowed them to practice and create a space to work on their course design (Rands et al., 2017).

Other participants felt the FLC positively influenced their teaching practice with critical support, resources, and encouragement during difficult times. Overall, it was widely supported that the Iowa State University FLC functioned in supporting faculty in adopting new teaching methods, like the TBL, and provided an effective model by creating connections amongst faculty, supporting transitions with new members, and developing a complex teaching strategy.

Faculty learning communities can also help newly hired faculty develop the skills and resources needed to eventually become tenured faculty. Faurer et al. (2014) conducted a study in which tenured faculty helped new, non-tenured faculty increase their productivity, adapt to university requirements, and create an environment of professional enhancement for the new faculty. Following a one-year commitment to the FLC, surveys were distributed to participants. The results determined that many study participants found this FLC to be a useful resource, and some even suggested that a longer FLC may be more viable (Faurer et al., 2014). It was also noted that the FLC served as a sense of community for its participants which could eventually help many achieve a tenure position in the near future.

During the last few decades, technology has become an inevitable feature of the learning experience and universities are continually looking for ways to incorporate technological innovations to improve students' experiences. Through the program Ensuring Access through Collaboration and Technology (EnACT), Ward and Selvester (2012) implemented a faculty learning community to provide universal access to the curriculum for their students and encourage faculty to adopt new technologies. The primary purpose was to help faculty acquire new knowledge, skills, and abilities to meet diverse student needs, including students with disabilities. The FLC participants were introduced to Universal Design for Learning (UDL) principles as a pedagogical framework to gain access to learning for diverse learners which encouraged participants to use technologies that would support universal access to the curriculum. The participants met twice a month in meetings that lasted approximately 90 minutes and were tasked with utilizing a new teaching practice, modifying a current practice, and using technology in an innovative way under the UDL principles. According to Ward and Selvester (2012), these assignments allowed for an open discussion, critique, and reflection for improving teaching practices among the faculty members. To gain a better understanding of the FLC experience, participants were given an open-ended questionnaire in which their responses remained anonymous. The questionnaire responses revealed an overall positive consensus regarding the FLC experience and that faculty had the opportunity to adopt the use of at least one type of technology to improve accessibility. The study concluded that an FLC served as a safe space for members to problem-solve, provide support for achievable changes, produce projects to improve teaching, exchange ongoing feedback, and learn a framework of accessible instruction using UDL principles.

Finally, Engin and Atkinson (2015) sought to integrate more technology into classrooms and were tasked with introducing iPads as a learning and teaching tool in all foundation language classrooms in Fall 2012. The goal was to provide iPads out across the university in degree-granting colleges by Fall 2014. This required changes in planning, materials, and curriculum. Thus, teachers had to participate in mandatory training. The training took place from September 2012 to February 2013 in the form of weekly input sessions and workshops and as a result, an FLC was formed. Data was collected from three sources. The first was the blog, where the participants shared their experiences, concerns, and questions in a bi-weekly blog posting. The blog posts were highly personal, significant, and thus meaningful. The second source of data was the facilitator notes taken during the FLC meetings. They were taken on an iPad and emailed to the participants after each meeting. The third source of data was a questionnaire sent to each participant to answer anonymously four months after meetings. The survey included questions on their experience of being in the FLC, the group's strengths, and suggestions for improvement for the future. Engin and Atkinson (2015) indicated that the FLC fulfilled the criteria of effective professional development with a positive impact in the collegiality and cooperation among members. Compulsory weekly iPad training provided an opportunity for meaningful activities directly relevant to each participant's teaching and learning situation. The learning was situated in a way that addressed their everyday teaching challenges and concerns. This was one of the most significant factors in the effectiveness of the faculty learning community conducted in this study.

Overall the previous studies examined relationships between FLCs and improved faculty and student outcomes. These positive outcomes resulted in faculty learning new teaching methods, creating a community with other faculty members, and modifying the current classroom curriculum. As noted above, adopting new and innovative technology was a significant factor in an FLC. The FLC was designed with the belief to help faculty create high-quality online videos that would improve pedagogy and faculty experience. It was crucial to interview the participants, as many stated, to get their feedback and experience all together. With that, the research would reflect the effectiveness of the FLC program to help video creations. The goal was to make sure people enjoyed and found the program useful in many ways such as editing, creating, and publishing. Previous participants enjoyed the outcomes of an FLC in helping them improve teaching styles. Cal Poly Pomona wanted to bring in a variety of disciplines to expand on this new program. The FLC in the presented study was intended to help faculty create supplemental videos that aid students with bottleneck or rigorous courses. Access to these videos would eventually become extra resources for students to use.

Methods

The Faculty Learning Community (FLC) in the present study had the sole purpose of teaching participants video creation skills and expanding online video resources for students. Participants were selected through a competitive process and from various disciplines at California State Polytechnic University, Pomona (Cal Poly Pomona). The option to participate was open to both tenured track and non-tenured faculty. In order to participate, faculty had to submit a letter of recommendation from their department chair, a commitment statement and complete an application. Thirteen participants were chosen by Dr. Paul Nissenson, Dr. Faye Wachs and Dr. Juliana Fuqua. The participants came from a range of disciplines, such as, Civil Engineering, Library, English & Modern Language, and Chemistry/Biochemistry. Participants were placed in four teams based on level of experience, objectives and goals consistent with the FLC's purpose. The four teams, and its twelve members, formed the first FLC at Cal Poly Pomona. Before the FLC started, participants were given hardware for video-creation along with the promise of a

five-hundred-dollar stipend upon completion of the Fall 2020 semester. During the Fall semester of 2020, participants were required to attend: an opening lunch, bi-weekly meetings and a wrap-up event. Participants had a similar schedule in the Spring semester of 2021; however, it is important to note that only six participants continued the FLC in the spring semester.

The participants' tasks in each semester differed. In the beginning, particularly in the Fallsemester of 2020, the bi-weekly meetings consisted of workshops organized by Dr. Paul Nissenson. Workshops varied from technical skills, practical skills and resources available for faculty. The participants' assignments, in Fall semester of 2020, consisted of creating four videos, demonstrating their skills and weakness in video creation. The topic of the four videos had to be related to the campus, course content, or a research interest. Each participant shared their own video with their team so teammates may critique the videos. A campus eLearning representative provided additional support and additional feedback on participants' videos. The Spring semester focused on participants conducting their own workshop on a topic of their choice. Hence, participants in the bi-weekly meeting in the Spring semester still learned video-creation skills, yet the topics were based on their own desires or interests.

In the bi-weekly meetings, participants completed a pre and post-survey, evaluating their perceptions of the day's workshop. The pre-survey asked questions regarding one's expectations of the day's workshops while the post-survey recorded one's satisfaction with the meeting. There was also an overall pre and post-survey for each semester, observing the participants overall experience. Once each semester reached its end, Dr. Juliana Fuqua and Dr. Faye Wachs conducted a formative evaluation by meeting with a participant individually. The questions ranged from, "What do you think you got out of the FLC?" to "What do you hope to get out of the future FLC?" The in-depth interviews gave a better perspective of the participants' views and thoughts of the FLC. Participants' privacy is confidential hence all names will be omitted from the study. The documentation of surveys and interviews were handled by eight undergraduate research assistants. The study design is a mixed-methods approach; however, there is an emphasis in the qualitative data. Interviews were heavily examined, transcribed and coded for similar themes. Quantitative materials, such as the surveys, were also examined, yet not an emphasis in the study. The mixed-methods of interviews and surveys allowed for the tracking of faculty's overall experiences in the FLC.

Results

Similar themes emerged throughout the two semesters from the formative evaluations. From attending the skill-building workshops and eventually teaching their own workshop, FLC members constantly created their own videos as practice. These videos could be related to the school, courses or to an area of research interest. With the main objective of the FLC being the growth of technical skills and production quality videos, technical advancements were one of the biggest themes observed. A participant revealed, "The FLC allowed me to create something, get the feedback and then go back and apply that feedback which made for a better product and then the more we did that, the better I got as we went along." Some examples of the skills gained through the FLC were editing,

adding audio, adding captions, presenting clear and concise information, and making sure the presentation is visible without any obstruction. There were workshops dedicated to navigating Camtasia and creating quizzes in Kaltura. Additionally, in the Spring semester of 2021, faculty felt like they could focus more on fine tuning their abilities which grew their confidence with technology.

With the growth of technical skills, faculty participants were able to create videos without uncertainty on how to work Camtasia. They knew where to start with editing and what information would be more convenient for students. Thus, increased confidence is an important theme observed. Faculty felt secure in their abilities to create quality videos. One stated, "Personally, I feel that I can provide much better multimedia content for my students, and I can convey the curriculum, convey my information in a much better format than I did before in a much more concise and easier way for them to consume this information." Participants were given the accurate tools and taught the skills needed to create videos which can better help students achieve in their course.

Once participants created and finalized their videos, they would share it amongst their teammates. Teammates consisted of participants affiliated with different disciplines which led to the strongest theme of interdisciplinary feedback. Watching other videos gave participants new ideas and new perspectives on presenting their course material. It helped members to think outside of their normative way of presenting materials and observe different styles of teaching. Seeing new methods of teaching provided some insight on the perspective of students; for example, some students might be inclined to visual aids. This inspired participants in including different ways of demonstrating concepts and also increased appreciation of other departments from how they operate in their courses.

The last highest recorded theme was an appreciation of the flexible and friendly style of the FLC. The flexibility came from a lax, laid-back attitude to completing assignments. This decision to have lenient due dates came from the need to be accommodating to others during the COVID-19 pandemic. As students were adjusting and balancing life expectations during the pandemic, so too were faculty members. Hence, participants had the opportunity to continue working on their videos or workshop after the deadline with no penalties. "You know we had a structure, but we also had some leeway on how to do things and how you know. Very fluid when it came to this FLC which I think is very good for it. Makes for a good atmosphere," one participant mentioned. Relaxed deadlines also contributed to an informal, friendly element of the program. The FLC provided a source of contact during the pandemic and increased the social interactions of the participants. Participants felt comfortable to share information about their personal lives and get to know other faculty, especially from other disciplines, better.

Discussion

This study reported results of surveys and qualitative interviews with 13 faculty members involved in an FLC. Participants in the FLC attended a series of meetings to enhance their video design skills and practiced them by creating videos of their own. Participants found the FLC valuable in improving their technical skills, which helped them create quality videos for students. As a result, FLC members also gained greater

confidence in their video design abilities and competence with video editing software. Moreover, their new skills and confidence prepared them to help others navigate online teaching during the COVID-19 pandemic. Many participants appreciated the FLC because not only were they able to improve their skills, but they also received helpful feedback from members in other disciplines. This interdisciplinary feedback fostered a supportive learning environment in which members exchanged ideas and learned from each other. Participants in the current study also found value in observations and support from other members. The benefits they recognized in the exchange between faculty were reflected in the participants' responses about how feedback allowed them to consider new ideas from those in different departments, implement new ideas and suggestions, and ultimately enhance the quality of their videos.

A more unexpected theme worth noting is the sense of community participants experienced in the FLC. Because of COVID-19, faculty were no longer on campus which limited interactions with peers. Interview responses highlighted that the FLC provided participants valuable opportunities for interaction and bonding. A similar study examined the experiences of community for online adjunct faculty in the United States and researchers found that those who felt a strong sense of community were empowered to better assist colleagues and students (Ferencz, 2017). Participants in the current study looked forward to FLC meetings and enjoyed collaborating with those who shared similar goals. This sense of community recognized by participants is especially important because it serves as a way for faculty to feel supported and empowered throughout the course.

Finally, participants frequently highlighted their appreciation of the flexible and friendly style of the FLC. Because of the ongoing changes related to the pandemic, participants required flexibility in meeting deadlines and finishing videos. FLC members were understanding of this and communicated within their groups that they needed additional time and support. As a result, participants could focus more on learning and practicing their newly acquired skills rather than having a perfect video prepared for their groups by the deadline. This flexibility contributed to the supportive learning environment and sense of community that the participants mentioned as benefits of the FLC.

The findings of the present study were consistent with previous research that concludes FLCs contribute to enhanced professional development, sense of community, and more positive outcomes for both participants and students (Engin & Atkinson, 2015; Faurer et al., 2014; Ward & Selvester, 2012). Facilitating a learning environment for faculty allowed participants to improve their skills while fostering opportunities for support, cooperation, and community-building amongst each other. Since the FLC was voluntary, participants were still required to manage other responsibilities including teaching multiple courses and navigating the pandemic. The flexible, friendly style of the FLC allowed faculty members to practice their new skills and provided a supportive space for participants to get their videos done without being penalized if they did not complete them on time. These results underscore the importance of an FLC in supporting overall faculty development, creating transformative change in the pedagogical experience, and essentially benefiting students' academic outcomes as well.

Future Research and Limitations

While participants favored and enjoyed the FLC, there were limitations to note in the study; such as, a limited sample size, the time frame and extent to which the FLC helped the participants is questionable. In the Fall semester of 2020, there were twelve participants from multiple disciplines, allowing for a comprehensive view of individual experiences. However, in the Spring semester of 2021, only six continued so about half of the data reflects a select few. Additionally, the time frame was limited to one year. The year-long program enabled a continued growth of technical abilities, yet this might have hindered it as well. Participants learned many skills and tools during the Fall semester of 2020 but in the Spring semester of 2021, some indicated that they did not learn as much. This leads into the third limitation as some participants learned many skills whereas some had a limited learning experience. Some participants were more familiar with the technology than others or felt like the topics did not fit their style of teaching. Thus, the learning experience depended on the faculty's desire and their level of technical knowledge.

During the Spring semester of 2021, there were many suggestions for improving the FLC. For example, since students are the intended audience, participants favored the idea of having student feedback on their videos. The research assistants of this study provided feedback, yet additional student feedback from those in the participants' courses could offer relevant insight on the presentation of materials. Moreover, additional feedback would enable the participants to see how students engage with the material and the aspects of the videos they favor. In addition, while participants favored the flexible, friendly style of the FLC, many noted the lack of accountability and consequence for non-participation. The pandemic was the cause of the lenient assignment deadlines and laid-back attitude; however, participants should continuously create videos to increase technical skills. Thus, some participants felt that while the leniency is beneficial, others would use excuses or put the assignments on the backburner.

Conclusion

The present study evaluated a year-long FLC in improving faculty's video creation skills and explored participants' experiences. The FLC had clear expectations and roles for participants to follow with an intent of improving pedagogy. Participants favored the FLC as it increased their technical skills while also allowing them a chance to meet interdisciplinary faculty. In addition, the FLC fostered new ideas and teaching strategies for participants. The participants at California State Polytechnic University, Pomona, may now produce high-quality videos, covering easy to complicated concepts, for students. However, the six to twelve faculty does not cover every discipline so the Faculty Learning Community should expand. Only then could it benefit many students, potentially increasing academic achievement and increasing pedagogical experience.

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Niwa Parish   **The Epistemic Violence of U.S. Settler Colonialism**

Abstract

This paper is focused on identifying the epistemic violence that is present in the project of U.S. settler colonialism. The central contention of this report is that Indigenous groups in America are susceptible to epistemic violence in the form of testimonial quieting (i.e. a form of testimonial silencing) as a result of the process of homeland-inscription. The first section of this paper is dedicated to explaining what the process of homeland-inscription is and how it relates to the project of U.S. settler colonialism. The second section of this paper is devoted to analyzing what epistemic violence is and providing information about the form of testimonial silencing that is referred to as testimonial quieting. In the next section, the notion of testimonial quieting is utilized to examine how the process of homeland-inscription leads to epistemic violence against indigenous groups through the formation and imposition of epistemically disadvantaged social identities. The fourth section of this paper applies the framework for understanding how homeland inscription leads to testimonial quieting to the history and experiences of the Karuk tribe located in Northern California. An objection is then posed that the process of homeland-inscription cannot be responsible for the epistemic violence suffered by indigenous groups since it is a purely physical process, not an epistemic one. The final section of this paper then responds to the proposed objection by explaining that homeland-inscription is both a physical and epistemic process.

Introduction

The central aim of this paper is to explore the epistemic dimension of U.S. settler colonialism by examining how Indigenous tribes in America have been subject to epistemic violence through the practice of testimonial silencing known as testimonial quieting. In this paper, I will argue that Native Americans are subject to epistemic violence in the form of testimonial quieting as a result of harmful settler ignorance, which is produced by the imposition of epistemically disadvantaged identities (i.e. those that have been constructed through the process of homeland-inscription) upon individuals from Indigenous groups.

This paper will begin by examining the concept of U.S settler colonialism as it is defined by Indigenous philosopher Kyle Whyte in a multitude of his works. I will then analyze the work of Kristie Dotson in order to introduce the notion of epistemic violence and explain what the form of testimonial silencing known as testimonial quieting is. In the third section of this paper, the concept of testimonial silencing will be utilized to examine and explain how Indigenous groups in America have been subject to epistemic violence as a result of, and a means to perpetuate, the process of U.S. settler colonialism. The notion that testimonial silencing can be applied to the historical treatment of Native Americans will be explored by examining the experiences of the Karuk people in Northern California regarding the dismissal of their testimony about the use of fire burning ceremonies to protect and manage the forests. I will then pose the objection that the process of homeland-inscription cannot

be responsible for the imposition of epistemically disadvantaged identities upon members of Indigenous groups since it is predominantly described in Whyte's work as a physical process that concerns the disruption caused by settlers within ecological systems. Finally, I will respond to this objection by asserting that there is an inherently epistemic dimension to the process of homeland-inscription that is utilized to bolster the efficacy of its physical functionality.

U.S. Settler Colonialism

Indigenous philosopher Kyle Whyte has spent much time and effort in multiple papers detailing the process of settler colonialism and how it accrues, or imposes, certain injustices upon Native American tribes, and Indigenous people across the planet, as a result. Much of Whyte's work focuses on the impacts of settler colonialism upon the ecology of native landscapes, and the health or wellbeing of Indigenous tribal members. In this paper, I will utilize Whyte's work on settler colonialism to provide salient background information that is necessary to understand the significance of the concept, and a framework that outlines how the process has occurred in the past and persisted into the present.

In one of his academic papers, Whyte provides a definition for the process of settler colonialism that details what the process is and how it occurs:
Settler colonialism refers to complex social processes in which at least one society seeks to move permanently onto the terrestrial, aquatic, and aerial places lived in by one or more other societies who derive economic vitality, cultural flourishing, and political self-determination from the relationships they have established with the plants, animals, physical entities, and ecosystems of those places. (Whyte, 2020, p.8).

According to Whyte, the individuals and groups that invade foreign territories with the intent to establish a new community are known as "settlers (Whyte, 2020, p. 8). Conversely, the individuals and groups that have historically lived on the land being invaded by settlers are referred to as "Indigenous peoples" (Whyte, 2020, p. 8).

Whyte introduces the notion of homeland-inscription in a separate paper and examines how it is a mechanism of settler colonialism that functions to transform the ecology of indigenous territories. Settler colonialism imposes certain harms upon Indigenous groups that are not inflicted through other forms of colonization (e.g. exploitation colonialism) since settlers are determined to permanently relocate onto the territories that have already been inhabited by Indigenous people (i.e. instead of merely focusing on the extraction of resources back to settler homelands) (Whyte, 2016, p.154). According to Whyte, "for a territory to emerge as a meaningful homeland for settlers, the origin, religious and cultural narratives, social ways of life, and political and economic systems (e.g., property) have to be physically engraved and embedded into the waters, soils, air, and other environmental dimensions of the territory or landscape" (Whyte, 2016, p. 154).

Settlers engage in the process of homeland-inscription when they arrive in new territories with the intent to alter the ecology of those environments by essentially erasing the perception of Indigenous people and their culture from the territory (Whyte, 2016, p.154). For example, settlers would be engaging in the process of homeland-inscription by forming parcels of land (i.e. within an indigenous territory) that they would then sell to farmers (i.e. other settlers) in order for them to utilize it for raising cattle and growing crops. In this case, settlers would be physically inscribing their cultural practices onto indigenous territories by forcing a shift away from hunter and gatherer tactics towards practices that focus on herding and farming instead. Settlers aim to transform the ecology of the territories that they desire to permanently occupy to ensure that their 'new' society has all of the necessary resources and systems in place for them to adequately adapt to, and function within, the environment that they are settling into (Whyte, 2016, p. 154).

The process of homeland-inscription that occurs through settler colonialism ignores the existence of environmental relations that have already been established by Indigenous groups: "The indigenous ecologies bear witness…to origin, religious and cultural narratives, societal ways of life, and political and economic systems that owe nothing to those same aspects of the homelands settlers seek to inscribe" (Whyte, 2016, p. 154). Native cultures and governments cannot simply be eradicated by settlers when they invade foreign territories and take over since indigenous practices and ceremonies have helped to shape the ecology of those lands and embed their presence into the environment. For example, Indigenous tribes that historically promoted hunter and gatherer practices have established ecological relationships within their environments by tending to native plants (e.g. by harvesting specific shrubs) and tracking the migratory patterns of certain animals. The elimination of those practices and the installation of other ones (i.e. the cultural practices and norms of settler societies) engenders disruptions within the environment that cannot be completely understood or resolved by settlers. The relationships that exist between Indigenous tribes and their environments, or the ecologies of their territories, pose a threat towards the settlers' aspirations of seizing their lands and exerting control over them (Whyte, 2016, p.155). These relationships are viewed by settlers as threatening since they disprove the idea that indigenous lands are available to be altered and settled upon (Whyte, 2016, p. 155).

In an attempt to eliminate the threat posed by the connections that Indigenous groups have within their native lands, settlers engage in a "sustained campaign" (i.e. the process of homeland-inscription) that seeks to eliminate the perception and existence of those relationships (Whyte, 2016, p.155, emphasis in text). Settlers accomplish this by forming moralizing narratives that describe the "inevitability" of their settlement; additionally, settlers aim to further the efficacy of this attempt to eradicate Indigenous connections to their lands by creating governmental institutions and processes "that serve to protect and incubate the inscription process" (Whyte, 2016, p. 155). In his book entitled In the Courts of the Conqueror, Walter R. Echo-Hawk examined how the judicial system has been historically utilized in America to bolster the perceived validity of false or misleading narratives that justify settler actions. Some of the misleading narratives about Indigenous tribes that are explored by Echo-Hawk are as follows:

The normal rules of international law requiring conquerors to respect property rights in the lands they occupy do not apply in America because Indian tribes are too savage and warlike…Native land is wasteland or a savage wilderness that no one owns, uses, or wants and is available for the taking by colonists— therefore any aboriginal interests in the land are extinguished as soon as British subjects settle the area…Native peoples have no concept of property, do not claim any property rights, or are incapable of owning land…Christians have a right to take land from non-Christians because heathens lack property rights… (Echo-Hawk, 2010, p. 45, emphasis deleted).

The formulation and promulgation of these false and misleading narratives are significant since they were historically utilized by the judicial system within the United States to make legal decisions regarding the rights and treatment of Indigenous groups; furthermore, these decisions were then set as precedents and used to make further legal arguments concerning the treatment and status of Native Americans. This process imposes a slew of harms upon Indigenous groups that already exist in the territories that settlers aim to occupy; additionally, the process of homeland-inscription erodes the environmental stability of these territories since the ecological transformation that is spurred by settlers cannot be sustained (Whyte, 2016, p. 155).

According to Whyte, the negative impacts that the process of homeland-inscription has upon members of Indigenous groups are extensive and severe:

Indigenous peoples, [as a result of homeland-inscription], are entirely forgotten or rendered invisible in the minds of settlers, or believed to have descendants today who are just fully assimilated citizens of the settler states, or subject to egregiously widespread sexual violence and murders (Smith 2005) and treated as 'sacrifice zones' for national military interests, or romanticized and stereotyped as victims of complete genocide who have no forms of collective self-determination today, or as shamanistic guides or noble savages. (Whyte, 2016, p.155).

The process of homeland-inscription that is used as a mechanism to further the project of settler colonialism functions to effectively erase the existence of Indigenous groups by altering the settler perception of them to such an extreme degree that they are essentially unrecognizable within their homelands. According to Echo-Hawk, "the phenomenon of retaining cultural identity with land thousands of miles away, while at the same time ignoring or marginalizing the local indigenous cultures, has engendered much of the human suffering and conflict found in settler states" (Echo-Hawk, 2010, p.23). This process of eliminating the ability of Indigenous peoples to be recognized within their homelands contributes to a form of epistemic violence known as silencing. Silencing functions as a form of epistemic violence that pertains specifically to the dismissal of certain individuals as incompetent sources of epistemic information (Dotson, 2011, p. 237).

Epistemic Violence

In her academic paper, Kristie Dotson examines the notion of epistemic violence and details how it occurs through practices of silencing. Epistemic violence differs from the broader notion of epistemic injustice since it pertains specifically to the elimination or

attempted eradication of entire knowledge systems (Dotson, 2011, p.236). This elimination of knowledge systems, and the concurrent imposition of epistemic practices from dominant societies (e.g. Western society), is accomplished through the silencing of the groups that endorse their use (Dotson, 2011, p.236) For the purposes of this paper, I will mainly be focusing on the practice of silencing that Dotson refers to as testimonial quieting.

As Dotson explains in her paper, an essential component for the existence and production of epistemic violence through testimonial practices is the reliance that speakers have upon their audience to successfully understand the testimony that they are providing (Dotson, 2011, p. 237). According to philosopher Jennifer Hornsby, the term reciprocity can be used to define the circumstances that must be met for a speaker to successfully convey their testimony to an audience: "'An audience who participates reciprocally does not merely (1)understand the speaker's words but also, (2) in taking the words as they are meant to be taken, satisfies the condition for the speaker's having done the communicative thing she intended'" (Dotson, 2011,p. 237). Hornsby's analysis of the relationship between a speaker and an audience in successful linguistic exchanges asserts that listeners play an active role in communicative exchanges; that is, an audience must have the desire and capabilities to accurately interpret a speaker's assertion to adequately satisfy the needs of the person that is dependent upon them to understand (Dotson, 2011, p. 238).

Epistemic violence is revealed in testimonial exchanges when a speaker is unable to have their testimony taken seriously by their audience as a result of them being unable or unwilling to adequately interpret the declaration being made due to their harmful ignorance (Dotson, 2011, p. 238). For example, epistemic violence would be present in a situation in which a woman testifies that there is something wrong with her physical health (e.g. "I am having unusually severe cramping/stomach pains") to a sexist male doctor who then wrongfully rejects her testimony (i.e. due to his harmful ignorance) and asserts that her health issues are the result of mental problems instead. Dotson uses the term 'pernicious ignorance' to refer to an individual's tendency to consistently overlook certain facts or information about an individual (or a group of individuals) in such a way that their incomprehension produces harmful circumstances for others; furthermore, this ignorance is accepted as a result of "a predictable epistemic gap in cognitive resources" (Dotson, 2011, p. 238). In the example provided above, the sexist male doctor's ignorance about the health issues faced by women is harmful because it results in him giving inaccurate diagnoses that result in further suffering for his female patients; furthermore, his ignorance about women's health issues is reliable since he endorses a specific set of beliefs (i.e. sexist ones) that consistently influence him to make certain inaccurate assumptions about testimony coming from women.

The inclusion of pernicious ignorance as a necessary factor for epistemic violence is significant since the reliable nature of an audience's incomprehension forms what Dotson refers to as a practice of silencing (Dotson, 2011, p. 241). Practices of silencing differ from instances (i.e. singular accounts) of silencing since they are the result of individuals systematically being unable to form accurate epistemic judgments due to their insensitivity to the truth concerning a specific realm of knowledge (Dotson, 2011, p. 241). The systematic nature of practices of silencing constitutes epistemic violence because they perpetuate and promote the occurrence of silencing against specific speakers in society (Dotson, 2011, p.

241). The main form of silencing that I will be focusing on for the purposes of this paper is testimonial quieting.

Testimonial quieting occurs when individuals have their testimony dismissed as a result of their audience being unable or unwilling to view the speaker as an epistemic agent (Dotson, 2011, p. 242). The inability of listeners to view individuals as epistemic agents results from their harmful ignorance; furthermore, this pernicious ignorance is usually the result of widespread stereotypes and stigmatizing concepts that have been imposed upon individuals belonging to certain social groups within society (Dotson, 2011, p. 243). According to Dotson, when the epistemic credibility of an individual is dismissed as a result of certain stereotypes or stigmatizing concepts, the ignorance that prevents them from being seen as a source of knowledge by the audience is a production of what Nancy Tuana refers to as an "epistemically disadvantaged identity" (Dotson, 2011, p. 243).

The inability of individuals to have their testimony accepted as a result of being imposed upon by epistemically disadvantaged identities is solely the result of the dependency that speakers have upon their listeners to communicatively reciprocate in exchanges of testimonial information (Dotson, 2011, p. 243). Dotson provides an example of this concept in her paper when she examined the work of Patricia Hill Collins in her book entitled Black Feminist Thought. According to Dotson's analysis of Collins's work, Black women in America suffer from testimonial quieting as a result of the proliferation and imposition of certain stigmatizing conceptions of Black women (i.e. epistemically disadvantaged identities) that prevent them from being seen as epistemic agents (Dotson, 2011, p. 242-243). Dotson further clarifies that the inability of Black women to be viewed as anything other than "mammies, matriarchs, welfare mothers, and/or whores" is the result of the fact that their audiences in testimonial exchanges possess harmful ignorance (Dotson, 2011, p.242); indeed, many listeners in testimonial exchanges reduce their perception of Black women solely to their epistemically disadvantaged identity without considering their epistemic capabilities as individuals (Dotson, 2011, p. 243).

In the next section of this paper, I will examine how the notion of testimonial quieting can be applied to the experiences of Indigenous tribes in America. I will argue that Native Americans are subject to epistemic violence in the form of testimonial quieting as a result of settler ignorance, which is produced by the imposition of epistemically disadvantaged identities that have been constructed through the process of homeland-inscription.

The Epistemic Violence of U.S. Settler Colonialism

The process of homeland-inscription that occurs as a means to further the project of settler colonialism in the United States both produces and contributes to epistemic violence against Indigenous tribes through the practice of silencing known as testimonial quieting by formulating stereotypes and stigmatizing interpretations of Native Americans that result in the creation of epistemically disadvantaged identities. The imposition of epistemically disadvantaged identities upon members of Indigenous groups results in the dismissal of their epistemic credibility by settlers due to their pernicious ignorance regarding the epistemic capabilities of Native Americans. The inability of Native Americans to be seen as epistemic agents by settlers within the United States constitutes epistemic violence since

the dismissal of their testimony has resulted in the infliction of a multitude of harms upon Indigenous tribal members. Indigenous tribes in America have suffered as a result of testimonial quieting since the inability of settlers to acknowledge their testimony has led to the elimination of sacred practices and knowledge systems that are essential to their livelihood; furthermore, the elimination of their sacred practices and the dismissal of their testimony about the environment has resulted in mass environmental injustice and degradation.

The process of homeland-inscription that was described in the first section of this paper produces epistemically disadvantaged identities that are imposed upon Indigenous groups since it functions to effectively erase the perception and existence of Native Americans within their territories. According to Whyte, the process of homeland-inscription alters the way that Native Americans are perceived by settlers in the United States since it entails the formulation and proliferation of specific narratives that exclude Indigenous perspectives to advance the idea that they no longer exist as they once did (Whyte, 2016, p. 155). Whyte explains in his paper that the widespread adoption of settler narratives by colonizers results in the perception of Indigenous peoples as either fully assimilated, victims of genocide, spiritual shamans, or savages (Whyte, 2016, p.155). The imposition of these stereotypical and stigmatizing identities upon members of Indigenous groups results in the dismissal of their testimony by settler societies since it results in the possession of pernicious ignorance by colonizers who then view them as incapable of being a source of knowledge. I will attempt to provide an example of this issue by focusing on the historical experiences and struggles of the Karuk tribe in Northern California.

Epistemic Violence in the Treatment of the Karuk Tribe

I am focusing on the experiences of the Karuk tribe in this paper since their tribal history has been explicitly documented, allowing for a seamless application of the notion of testimonial quieting. There is a multitude of court cases and historical events that can be utilized to demonstrate how Native Americans have been subject to testimonial quieting in the United States; however, engaging in an overall analysis of how the notion of testimonial quieting can be applied to the experiences of tribal nations across the country and throughout history would be too extensive of a task to engage in for this paper. The application of testimonial quieting to the experiences of the Karuk tribe in Northern California should provide an adequate framework for understanding how the process of homeland-inscription results in the production of epistemically disadvantaged identities that have prevented Indigenous individuals from having their testimony properly interpreted or understood.

In his paper, Kyle Whyte explained that the Karuk people are part of an Indigenous tribe that has territory in Northern California and Oregon (Whyte, 2017, p.359). Members of the Karuk tribe have maintained that their cultural practices and knowledge systems are essential to managing the environment properly (Whyte, 2017, p.359). According to Whyte, the Karuk people have a historic relationship with their territory in which they have served as environmental stewards, caring for the environment to protect the wildlife and yield all of the natural resources that they needed to provide living materials and sustenance (Whyte, 2017, p. 359). One of the essential components regarding the Karuk people's

stewardship of their land was the use of burning practices that they incorporated into cultural ceremonies to renew their relationship with the land, and produce the proper conditions for harvesting and hunting for food (Whyte, 2017, p. 359). In his article, Dave Roos examined how important the use of fire was for Indigenous groups and their ability to sustain and maintain their communities. According to Roos, the use of controlled burns by Native Americans had a multitude of positive effects, including the promotion of seed germination (e.g. the germination of acorns and sequoia trees) and the creation of pasturelands for animals to graze on (Roos, 2021). Cultural burns were also utilized to herd animals that were proceeding along with their migratory patterns, eliminate pest problems, and promote the proper environmental conditions for certain plants or shrubs to grow (i.e. by clearing out old undergrowth) (Roos, 2021).

The Karuk people view their fire burning ceremonies as an essential component to maintaining harmony within the forests of their region (Whyte, 2017, p. 360). The ability of the Karuk people to maintain their cultural practices and knowledge systems was severely hindered by the arrival of settlers in the region that is now known as California (Whyte, 2017, p. 360). According to Roos, the entry of Spanish settlers in the California region during the 1800s also marked the arrival of smallpox for Indigenous groups located there and that led to a subsequent population loss of around eighty to ninety percent (Roos, 2021). This dramatic decrease in the population of Native Americans led many settlers to believe that the environments in the areas that they inhabited were formed through completely natural forces (i.e. without any interference by Indigenous Peoples) (Roos, 2021). The erroneous notion that Native Americans did not engage with their environments fails to account for the dramatic impacts that their cultural practices, including cultural burns, had upon the ecologies that they were living in. The arrival of settlers in the California region led to the elimination of cultural burns since the colonizers believed that fire is a dangerous and harmful force that fails to secure any environmental benefits; furthermore, settlers felt that cultural burns were a 'primitive practice' that posed a threat to their cattle and the timber that they sought to utilize (Roos, 2021).

Settlers that arrived in the area forced the Karuk peoples from their land and they even murdered some tribal members for attempting to engage in cultural burning ceremonies (Whyte, 2017, p. 360). The inability of Indigenous tribes to engage in cultural burns led to the accumulation of debris within the forests and significantly worse wildfires (Roos, 2021). Despite assertions from Indigenous tribal members that cultural burns are necessary to thwart extreme wildfires, and in response to the "Great Fires of 1910", the Federal Government passed the Weeks Act of 1911, which permitted "the government's purchase of millions of acres of land in which all fires would be outlawed" (Roos, 2021). The cultural practices of Indigenous peoples (i.e. gathering natural resources in forests and setting controlled burns) were outlawed despite their knowledge-based roots and they remain illegal today (Whyte, 2017, p. 360). The Karuk tribe cannot legally practice controlled burns on their ancestral lands since they have only been able to secure a small portion of the forest territories that were originally theirs (Karuk Tribe, 2020, p. 1). The Karuk tribe did not regain any of their original lands when they received federal tribal recognition in 1979; however, beginning in 1977, tribal members resorted to purchasing small portions of their ancestral lands in order to establish reservations (Karuk Tribe, 2020, p. 1). The limited scope of their property has prevented them from being able to fully engage with their

cultural practice of performing controlled burns.

In her article, Lauren Sommer explores how the banning of Indigenous burning ceremonies has resulted in extreme wildfires. According to Sommer, the reliance that governmental agencies have upon methods of fire suppression has resulted in extreme wildfires in the state of California because it promotes the excessive growth of vegetation that ultimately dies and serves as fuel for massive fires (Sommer, 2020). The excessive and severe nature of California's recent wildfires is highlighted by the fact that the past decade has seen eight of the worst (i.e. largest and most intense) wildfires in California's history (Krishnakumar, 2020). The severity of recent wildfires in California, and the rapid pace at which they seem to be appearing, has motivated many Native Americans to reach out and offer their help in performing controlled burns in an attempt to diminish the threat of uncontrollable infernos (Sommer, 2020). As Sommer explains in her article, the people of the Karuk tribe in Northern California have formed a partnership with the local forest agency to share their knowledge about controlled fires and participate in the management of the forests (Sommer, 2020).

The historical mistreatment of the Karuk people by settlers in the United States and their governmental systems is a result of epistemic violence through the practice of silencing known as testimonial quieting. The Karuk people were historically viewed by settlers as incapable of being epistemic agents since stereotypes and stigmatizing narratives about them were promoted through the process of homeland-inscription, resulting in the production of epistemically disadvantaged identities that were then imposed upon them. The process of homeland-inscription applies to the historical struggles of the Karuk tribe since settlers sought to physically alter their ancestral environments (i.e. by herding cattle, establishing farms, and chopping down timber) in order to form their communities; furthermore, these communities, and the cultural practices that they emphasized (e.g. fire-suppression tactics), completely ignored the established relationships that the Karuk tribe had with their environment.

The notion that Native Americans were 'savage' and incapable of having or sharing knowledge, which was promoted by settlers, prevented the testimony offered by the Karuk tribe from being accurately interpreted and acknowledged by settler audiences; indeed, the refusal by settlers to entertain the notion that controlled burns were positive arose directly from the fact that their culture viewed the practice as harmful and 'primitive' (Roos, 2021). Even though the Karuk people in Northern California have had extensive knowledge about their environment and the ecological systems that function within it, settlers did not communicatively reciprocate in testimonial exchanges with them as a result of their harmful ignorance (i.e. as a production of the epistemically disadvantaged identities that were imposed upon the Karuk people through the process of homeland-inscription) and, thus, their testimony failed to be acknowledged. The ignorance possessed by settlers within the United States should be seen as harmful since it resulted in the elimination of Indigenous ceremonies that serve as an essential component of the tribal members' ability to flourish; furthermore, the elimination of these ceremonial practices, and the suppression of the cultural knowledge systems, has contributed to the issue of extreme environmental degradation and destruction.

The Non-Epistemic Homeland-Inscription Objection

An objection to the idea that Native Americans have suffered from epistemic violence in the form of testimonial quieting as a result of the project of U.S. settler colonialism (i.e. due to the formulation and imposition of epistemically disadvantaged identities that occurs through the homeland-inscription process) is that the process of homeland-inscription cannot be responsible for the formulation and imposition of epistemically disadvantaged identities since it is a physical process, not an epistemic one. This objection arises from the fact that homeland-inscription is described by Kyle Whyte as "a wide-ranging and physical endeavor" (Whyte, 2016, p.154, emphasis added); furthermore, Whyte asserts that the process of homeland-inscription occurs when settlers physically imprint their cultural values and practices upon the varying dimensions of indigenous territories (Whyte, 2016, p.154). This interpretation of homeland-inscription is significant since it implies that the process cannot be responsible for the epistemic harms suffered by Native Americans because it is only concerned with the tangible efforts and actions of settlers. The formulation and promulgation of moralizing narratives that justify settler actions against Native Americans (i.e. by imposing epistemically disadvantaged identities upon them) cannot be entailed through the process of homeland-inscription since it is not an inherently epistemic practice.

The Epistemic Dimension of Homeland-Inscription Response

This objection is ultimately unsuccessful in proving that the process of homeland-inscription is not responsible for the impositions of epistemically disadvantaged identities upon members of indigenous groups since there is an inherently epistemic dimension to the process. Although Whyte does describe the process of homeland-inscription as a primarily physical exercise, its scope cannot be limited to merely the tangible efforts of settlers to erase the perception of Indigenous groups from their territories. This process necessarily has an epistemic dimension to it since it pertains to the erasure of cultural knowledge systems and the implantation of foreign practices and beliefs to justify the process of settler colonialism. The epistemic dimension of homeland-inscription is essentially detailed in this excerpt from Echo-Hawk:

Colonists invariably retained close cultural ties to homelands across the sea and rarely assimilated indigenous values or ways of looking at Mother Earth. Instead, they imposed their European cultures, languages, and religions upon tribal people. Missionaries, schools, soldiers, and governments tried to assimilate Native Americans into the settlers' culture. (Echo-Hawk, 2010, p.24).

Whyte's description of homeland-inscription as a wide-ranging process implies that it encompasses much more than the merely physical efforts and actions by settlers to justify the elimination of Indigenous groups and their cultures. As Echo-Hawk explains in his book, Native Americans have historically been silenced by the government and had their views marginalized so that settlers could easily justify their pillaging of indigenous land and natural resources (Echo-Hawk, 2010, p.23-24). Whyte describes this epistemic dimension of the homeland-inscription process within his paper when he highlights how settlers formulate moralizing narratives and utilize governmental institutions to further their process of settlement (Whyte, 2016, p.155).

The formation and promulgation of the moralizing narratives that are utilized by settlers are harmful to Indigenous peoples as knowers since they impose epistemically disadvantaged identities upon them. These epistemically disadvantaged identities prevent settlers from perceiving Native Americans as epistemic agents; furthermore, the governments that settlers create serve to support the imposition of epistemically disadvantaged identities upon people belonging to Indigenous tribes by reinforcing the principles and ideas that are conveyed through their moralizing narratives. The imposition of epistemically disadvantaged identities upon Indigenous peoples is harmful since it prevents settlers from viewing them as knowers, which ultimately leads to the elimination of their knowledge systems and cultural practices. The loss of these cultural practices and knowledge systems has devastating consequences upon both Native tribes and the environment since their development has been historically intertwined.

In the case of the Karuk tribe that was detailed above, the process of homeland-inscription displayed both a physical and an epistemic dimension since it pertained to the perception of fire (i.e. the cultural knowledge of fire and how it is used) in addition to its actual use (or disuse) as a means to physically alter the environment. The formation and promulgation of European narratives regarding the danger of fire and the primitive nature of Native American cultures were essential to ensuring that settlers could effectively establish their new communities. The process of homeland-inscription would not be able to function effectively (i.e. settlers would not be able to impose new communities with different cultural values) if there was not an epistemic dimension (i.e. moralizing narratives) that aims to justify the elimination of indigenous practices. The epistemic treatment enacted against the Karuk tribe was harmful since it prevented them from being able to maintain their knowledge systems and engage in their cultural practice of performing controlled burns; indeed, the Karuk tribe's inability to utilize their knowledge systems and the associated cultural practices led to physical damage and harm in the form of intense wildfires and environmental degradation.

The argument that homeland-inscription is merely a physical process cannot withstand the reality that its tangible properties have epistemic consequences as well. Native American tribes have specifically developed their knowledge systems and cultural practices so that they are physically embedded into the environment. Their knowledge about seasonal cycles, harvests, and migratory patterns has enabled them to develop cultural practices that inscribe their own presence into the environment. When settlers invade indigenous territories and alter the landscapes through the process of homeland-inscription, they are effectively destroying the knowledge systems developed by Indigenous groups since those epistemic practices were based upon the environmental properties that were theretofore in existence. The destruction of those knowledge systems is ensured through the physical alteration of indigenous territories since it effectively eliminates the applicability of the epistemic and cultural practices that the Native groups had developed.

Conclusion

In this paper, I have attempted to demonstrate how the notion of testimonial quieting can be applied to the historical treatment of Indigenous groups in America as a result of U.S. settler colonialism. I argued that Native Americans are subject to epistemic violence in the form of testimonial quieting as a result of harmful settler ignorance, which is produced by the imposition of epistemically disadvantaged identities (i.e. those that have been constructed through the process of homeland inscription) upon individuals from Indigenous groups. I began by explaining what settler colonialism is and how the process of homeland-inscription occurs and what it entails. I then proceeded to examine what epistemic violence is and what constitutes the practice of silencing known as testimonial quieting. The frameworks provided for understanding homeland-inscription and testimonial quieting were then combined to examine how epistemic violence occurs as a result of US settler colonialism. This examination was executed by applying the concepts of homeland-inscription and testimonial quieting to the experiences of the Karuk tribe in Northern California and their attempts to provide testimony about the use and importance of cultural burns. I then posed the objection that the process of homeland-inscription cannot be responsible for the imposition of epistemically disadvantaged identities upon Native Americans since it is a physical process and not an epistemic one. In the final section, I responded to this objection by arguing that there is an inherently epistemic dimension to the process of homeland-inscription since it requires that the cultural practices and values of Indigenous groups (i.e. their knowledge systems) be replaced with those of the colonizers in order to justify their settlement into indigenous territories.

While I was able to analyze the experiences of the Karuk tribe within this paper, I was not able to engage in an in-depth analysis of how the framework for identifying the epistemic violence that is present in the project of U.S. settler colonialism can be applied to all of the experiences of Native American tribes; however, I do believe that the information provided in this essay on how the process of homeland-inscription leads to testimonial quieting can be utilized to examine and explain how the experiences of many Indigenous tribes in the United States have been shaped by epistemic violence. The ability to identify how Native Americans have been subject to testimonial quieting is significant since it enables people to understand the importance of indigenous knowledge systems and the devastating impacts that their erasure has upon tribal communities and the environment. Recognizing the issues that are presented and cultivated by the epistemic violence that is existent in the project of U.S. settler colonialism is the first step towards developing solutions for those problems.

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Building a Blockchain Network for Urban Farms and the Food Supply Chain.

Abstract

Urban farms are complementary to conventional rural agriculture, completing the diverse bounty of crops required to maintain a healthy diet of nutrients. However, urban farms present unique challenges from conventional agricultural development, specifically including brownfields and land revitalization (U.S. Environmental Protection Agency, 2011). Furthermore, while the geographic proximity of the producer to the consumer is minimized, food supply chain challenges are still present. Some challenges include guaranteeing organic versus conventional crops, whether sustainable methods are being implemented, where seeds were sourced from, or handling food safety events. This review analyzes how blockchain technology can impact urban farming and its unique supply chain. The objective is to establish trust between producers and consumers, facilitating food safety procedures, and integrating transparency so all participants in the chain will continue to confidently engage and grow.

Introduction

This review begins with describing what the food supply chain is and the challenges it experiences. Urban farming is also briefly described and what makes it a unique form of farming when compared to traditional rural farms. Also, blockchains are introduced, explaining their benefits, including decentralization, transparency, and the use of smart contracts. In addition, the use-case of Walmart is presented, showing the benefits of blockchain technology to the food supply chain. Finally, a case is argued for blockchain technology's impact on brownfield remediation, intended for the use in urban farms.

The Food Supply Chain

The food supply chain refers to the steps required to provide consumers healthy food. These steps, or processes, include farming, production, distribution, retail, and finally the consumer. As food is moving from farmer to the consumer, money is simultaneously moving in the opposite direction on the same chain. Various people and resources are employed as part of each of these processes including farmers, packagers, logistics and retail personnel. When an event impacts one of the processes along the chain, it is often manifested as an increase in price along the remainder of the chain (Harvard, 2021). In addition, other factors include the mishandling of food which would lead to food recalls and is categorized as food safety (Harvard, 2021). Finally, there is the issue of food security, which guarantees that everyone has access to healthy, nutrient rich food regardless of location or income.

Farming

The farming process can be divided into three subprocesses: preplanting, cultivation and harvesting. Pre-planting operations in sequence include selection of the site, surveying of the soil and land measurement, clearing, stumping, field plotting or farm layout, tilling or

ridging, plowing, harrowing, nursery and nursery practices. Cultivation is the process of tilling or loosening soil to prepare it for planting. It is often an essential method for maintaining soil health, preventing weed development, and encouraging crop growth (Chait, 2020). The gathering of agricultural crops upon maturity, or the practice of harvesting, signals the end of the production cycle prior to storage and processing (Harvesting Operations, 2011). The size and quality of the crop removed from the field, orchard or vineyard represents the most significant measure of a farmer's productivity and success. Once the crops are harvested they are made ready to be sold and delivered to the food producers.

Production

The process of converting raw ingredients into edible food is called food production. The production or processing of food varies depending on the type being handled. Some of the methods involved in the processing of food may include cleaning, sorting, slicing, cutting, marinating, boiling, frying, mixing, or grinding (Vedantu, 2021). Another significant step involved during the production of food is it's packaging (Vendantu, 2021). Fruit and vegetables can simply be cleaned and tied in bundles or filled in a crate. Other food packaging can be much more complex, such as being bagged in plastic envelopes and vacuum sealed to maintain freshness and longevity, or even the addition of gasses, such as nitrogen, which act like preservatives. Once packaging has been completed it is available to the distributors and wholesalers.

Distribution

Food distribution includes the collecting of food which has been prepared by the producers and transported or stored in warehouses to then be dispersed to the various grocers, restaurants, cafeterias, or government aid programs (Fram, 2019). The time of the distribution and the methods implemented depend on the food being handled. If the item requires refrigeration, then a cooled warehouse and refrigerated vehicles are used such as in the case of transporting fish. Sometimes food is simply delivered directly from the food processor to the retailer, skipping the warehouse such as in the case of farm-fresh fruit or vegetables. Finally, according to Fram (Fram, 2019), food distribution may also include products that help with food consumption such as plates, cups, utensils and napkins. Regardless of being received from a food processor directly or from storage in a warehouse, the food always arrives in the retailers hands to reach the consumers.

Retail

The retailer handles the merchandising and making the products physically available to consumers. While all the previous steps required that the food be purchased in bulk the retailers offered the option to purchase products on a per unit basis. The food retail industry contains any business that sells food to consumers for preparation and consumption. These businesses can include grocers, retail supermarkets, chain or franchise restaurants, hotels and cafeterias, etc.

Consumer

By definition a consumer is a person who purchases goods and services for personal use. In the supply chain, a consumer is a key figure and their needs and opinions affect the supplier's decisions. Retailers, shipment, and corporations alike are changing their operations in response to the preferences of the consumers they serve.

Urban Farming

Urban farming is the practice of cultivating, processing and distributing crops and livestock in urban areas, using techniques such as vertical farming, indoor farming, hydroponics, aeroponics, aquaculture, and aquaponics (Ng and Mahkeswaran, 2003; US EPA, 2015). Vertical farming, according to the US EPA, is to farm up to the sky instead of out to the side and usually use stacked layers on rooftops or building facades. Indoor farming uses commercial or residential buildings, greenhouses, warehouses or shipping containers. Hydroponics consists of plants with their roots fully submerged in nutrient-rich solutions, while on the other hand aeroponics consists of spraying the nutrient-rich solution onto the roots of the plants occasionally. Aquaculture involves farming of fish and shellfish in all kinds of water environments. The combination of aquaculture and hydroponics creates a symbiotic closed-loop ecosystem known as aquaponics (Ng and Mahkeswaran, 2003).

The development of urban farming emerged from the attempt to move away from conventional farming— the use of genetically altered seeds that are not certified as organic (USDA Coexistence Factsheets - Conventional Farming, 2015). Moving away from conventional farming into urban farming creates opportunities to adopt environmentally sustainable practices with the reduction in or elimination of deforestation, land degradation, environmental pollution, use of fertilizer, excessive water usage, and high carbon footprints that would normally be functioning in conjunction with conventional farming (Ng and Mahkeswaran, 2003, USDA).

Contrary to popular belief, urban farming is not the same as community gardening, homesteading or subsistence farming. Unlike the three other types of farming, urban farming takes part in commercial activity and grows products to be sold as opposed to being consumed or shared on a personal level (Ng and Mahkeswaran, 2003; US EPA, 2015). Although not intended to be operated for direct personal use, any individual can run an urban farm as long as the primary goal of raising food to be moved from grower to user is met.

The goal cannot be met with urban techniques alone. In order for urban farming to reach its fullest potential, it must be coupled with technological innovations to revolutionize farming. One technological innovation in particular is of most interest: blockchains. The unique attribute of blockchains is their design to embrace a decentralized system, which consists of a cryptographically managed network of blocks with the sole purpose of storing information.

Blockchains

A ledger is a book or a list where accountants record transactions, such as sales or purchases. Those transactions are often timestamped, meaning that a date and time is included in the details of the record. Ledgers are also intended to only ever be added to and never removed from. This means that a ledger is not supposed to have an entry erased. Once a transaction has been recorded it remains in the ledger permanently. A blockchain, fundamentally, is a distributed digital ledger, but can be more complex and record more than mere information about transaction details. Nevertheless, the principle is the same, record a transaction and never change or delete it.

Unlike the physical book that remains in the accountant's desk drawer, unshared and private, a blockchain has no such constraints. It is a shared ledger where all participants, and not just the accountant or clerk alone, have access. This way each participant can obtain their own copy. A blockchain is therefore said to be distributed, allowing everyone visibility to all the records ever recorded in the blockchain and can append additional records if needed because everyone has a copy of the ledger.

In addition to the visibility and access, blockchains strive to be decentralized, meaning they attempt to reduce the level of trust required between participants, deterring their ability to exert control or authority so as to compromise the network. Control, decision-making and administration is transferred from an individual, group, or organization to a distributed network. Untrusted participants are fundamental to a blockchain (Loukides, 2018).

A smart contract is a secure and unstoppable computer program representing an agreement that is automatically executable and enforceable (Bashir, 2017). Smart contracts are a feature of blockchains allowing for transactional logic to be included as part of the block, meaning that once certain criteria are satisfied the transaction will be recorded.

According to Nick Szabo, "A smart contract is a computerized transaction protocol that executes the terms of a contract. The general objectives are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries. Related economic goals include lowering fraud loss, arbitrations and enforcement costs, and other transaction costs" (Bashir, 2017).

Blockchains and Urban Agriculture

In 2016, Frank Yiannas, former Vice President of Food Safety at Walmart described the food supply chain as "not actually a chain, but a complex network" (Walmart Case Study – Hyperledger Foundation, 2021). Being that it is a complex network, when a food-borne disease outbreaks it's difficult to locate the source; therefore, the government steps in to broadcast which products to avoid. In this case, this is where blockchains come in and help to minimize the time of finding the source. The traceability of blockchains would not only enable urban farms to be more time efficient, but they would save lives and protect the livelihood of farmers by only discarding produce from affected farms

(Walmart Case Study – Hyperledger Foundation, 2021). The center focus of blockchain technology is trust, immutability, and transparency; all of which happen under the decentralized, shared ledgers. Through the Hyperledger Fabric Technology, Walmart was able to conduct two blockchain tracing application tests regarding two products: mangos and pork. In the test of the mangos, Yiannas bought a packet of sliced mangos and asked his team to identify, as quickly as possible, which farm they came from; this process took them seven days to identify (Walmart Case Study – Hyperledger Foundation, 2021). With the success of Hyperledger Fabric blockchain technology, the time needed to trace the location of the sliced mangos decreased from seven days to 2.2 seconds (Walmart Case Study – Hyperledger Foundation, 2021). Clearly the effectiveness of blockchains can be seen and how it can help to further develop the food supply chain and urban farms.

The Environmental Protection Agency (EPA) defines a "Brownfield Site" as, "... real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." (United States Environmental Protection Agency, 2002). They estimate more than 450,000 brownfield sites across the United States which can be revitalized and reused for, but not limited to, urban farms (United States Environmental Protection Agency, 2021). According to Haninger, Ma, and Timmins, land revitalization is a beneficial, yet costly, process to undertake due to the procedures which are necessary to deal with the harmful substances found in the soil from previous use. With the high-risk to health which these sites pose it is imperative that a meticulous record of the cleanup efforts be maintained. Records establishing property in preparation for human occupation, while land rights or usage are being negotiated, will meet all health and safety regulations. As such, a blockchain would be an ideal tool to guarantee the validity and traceability of the cleanup, containing information with respect to what contaminated material was removed, where it was disposed, what it was replaced with, and where that replacement material was sourced from. These are all important bits of information that either the new tenant of the land and the local jurisdiction would need to confidently know. A blockchain dedicated to land administration or a land registry, keeping records of transactions, including cleanup efforts, between farmers and landowners would be key to successful urban farm development. At the same time this allows governing agencies to monitor the land and its operation. Transactions can be guaranteed through smart contracts and the use of IoTs, sampling soil conditions and readiness, protecting farmers and consumers of the crops.

Conclusion

In this paper we discussed what the food supply chain is and the challenges it experiences. Urban farming has also been briefly described and what makes it a unique form of farming relative to traditional rural farms. In addition, blockchains were introduced and also described their benefits, including decentralization, transparency, and the use of smart contracts. Also, the use case of Walmart was presented, showing the benefits which a blockchain can have to the food supply chain. Finally, a case was made for how impactful blockchain technology would have on land revitalization for the use in urban farms, guaranteeing the farmer and governing bodies a clear and confident path to their successful use.

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The Potential Role of the Fc Receptor, FcγRII2a in the Trogocytic Killing of Trichomonas vaginalis by Neutrophil-Like Cells

Abstract

Trichomoniasis is a sexually transmitted infection (STI) caused by a protozoan, the Trichomonas vaginalis (Tv). Tv affects more than 300 million men and women worldwide. There is evidence that neutrophils use a process called trogocytosis to kill Tv. Trogocytosis is a process in which a cell, such as a neutrophil, takes "bites" out of its neighboring cell. It has been shown that opsonization by antibodies is essential for the killing of Tv by neutrophils. Opsonization is the coating of a pathogen with antibodies to crosslink cells, such as neutrophils, to the pathogen. A specific study discovered that antibody receptors (Fc-receptors), such as FcγRIIa (CD32a), can be necessary for the trogocytosis process against cancer cells. We hypothesize that CD32a is also important for neutrophils to trogocytose and kill Tv. To test this, we will knock out the CD32a gene using the CRISPR/Cas9 system. We generated CD32a knockout neutrophil-like cells (NLCs) and performed cytolysis assays to show whether trogocytosis was affected by that CD32a knockout. We have already created a target sequence and an HDR donor oligo that will mediate CD32a knockout. We confirmed the presence of CD32a in NLCs. We also performed a cytolysis assay to optimize differentiation reagents for generating NLCs. Using the same method of cytolysis, we also confirmed the significance of Fc-receptors in the neutrophil killing of Tv by testing the effect of an inhibitor of signaling downstream of the Fc-receptor. We hope that after we successfully transfected the CD32a knockout sequence into the precursor cells and differentiated the cells into NLCs, we will perform functional assays.

Introduction

Trichomonas vaginalis (Tv) is a protozoan parasite that causes a sexually transmitted infection (STI) called trichomoniasis in humans. The World Health Organization reports over 300 million infections worldwide [1,2]. Although many trichomoniasis infections are reported, cases in which the infection is asymptomatic are prevalent [3]. Tv can affect both men and women, but the infection is more prominent among women between the ages of 14-49 [4]. Women of color with low socioeconomic status are most affected by trichomoniasis [4]. Even though Tv is treatable with antibiotics such as metronidazole and tinidazole, there is an increase in Tvstrains reported that are resistant to metronidazole [5]. Tv is also reported to increase susceptibility to HIV and to cervical cancers in those who are HPV positive [6,7]. Tv is also associated with infertility and affects infants of infected mothers causing low birth weights and premature births [5,8].location or income.

The immune response to Tv includes the influx of neutrophils to the area of infection where they attack Tv [10,11]. Neutrophils have three different modes of killing; phagocytosis, extracellular degranulation, and a process called Neutrophil Extracellular Traps (NETosis) [11]. A fourth mechanism of killing neutrophils utilize is called trogocytosis [12]. Trogocytosis is characterized as the process of "nibbling" or taking "bites" from the surface of a target cell [12]. We know that trogocytosis is important for neutrophil killing of Tv [12]. However, the mechanism of trogocytosis has yet to be fully understood.

Opsonization of Tv by antibodies has been demonstrated to be necessary for trogocytosis activity in neutrophils [12]. Neutrophils collaborate with the adaptive immune system through antibody-dependent activation of trogocytosis [13]. Neutrophils also utilize trogocytosis to kill cancer cells [13,14]. Neutrophils use Fc Receptors to bind to antibodies to trigger the process of trogocytosis [13,14]. It has been shown that the blocking of Fc receptors on neutrophils leads to a reduction in trogocytosis of Tv [12]. Matlung et al., in Neutrophils Kill Antibody-Opsonized Cancer Cells by Trogoptosis, test neutrophil trogocytosis of cancer cells using Fc-Receptor-blocking antibodies. Many surface Fc receptors were blocked in the study using Fc-receptor blocking antibodies that interact with the Fc-receptor on the neutrophil. When the Fc-Receptors interact with the blocking antibodies, the receptors on the neutrophil won't interact with the antibodies against the cancer cell.[13]. The experiment showed that neutrophil trogocytosis decreased in the presence of antibodies that block Fc-receptors [13]. All the evidence above led us to hypothesize that Fc-receptors may be important for the killing of Tv.

However, there are several different Fc Receptors that neutrophils express. Matlung et al. found that FcγRIIa(CD32a) had the largest effect on trogocytosis of cancer cells among the other Fc Receptors [13]. CD32 has three different polymorphic variants; CD32a, CD32b, and CD32c [15]. Although CD32b and CD32c have identical extracellular domains, CD32b contains an immunoreceptor tyrosine-based inhibition motif, and CD32c has an immunoreceptor tyrosine-based activating receptor [15]. What differs between the variant receptor CD32a and CD32b/c is that CD32a has a higher binding affinity to IgG than CD32b/c. The low expression of CD32b/c may indicate that the variants; CD32b/c may not have a significant enough role in the killing of TV. In the Matlung et al. study, neutrophils incubated with blocking antibodies showed neutrophil trogocytosis of cancer cells[15]. Because the blocking of the receptor CD32a showed a decrease in neutrophil trogocytosis activity [13], we can predict that knocking-out CD32a expression in neutrophils will show a significant decrease in trogocytosis of Tv.

To knock out CD32a expression in neutrophils, we used the CRISPR/cas9 system. The CRISPR/cas9 system is used to modify and edit genomes[16]. To modify a genome, the Cas9 makes a double-stranded cut in the DNA of the target cell, and the cell tries to repair the DNA. [17]. The two methods that the cell uses to repair DNA includes nonhomologous endjoining(NHEJ) or homology-directed repair(HDR) [17]. We used the HDR method of repair for our cells to create a CD32a knockout. The HDR method would allow insertion sequences that would control where the mutation in the gene would occur. To use the HDR method, we must create an HDR donor oligo. The HDR donor oligo is an 80-90 base pair sequence that contains our target crisprRNA that will tell Cas9 where to cut and two flanking sequences. [17]. Flanking sequences are 30-40 base pair sequences upstream and downstream from the target crisprRNA sequence. Flanking sequences are designed to repair the cut made by Cas9, and the mutation will be the same in every cell after transfection[18]. We include HDR donor oligo to a ribonucleoprotein complex (RNP). The RNP containing our target CRISPR RNA (crRNA)[17]. The HDR method would allow Cas9 to create a cut in the DNA of our cells, and the cell would use an HDR donor oligo to repair the DNA and make a mutation in the process. [17]. We hypothesize that knocking out CD32a utilizing the CRISPR/Cas9 method will decrease neutrophil ability to perform trogocytosis of Tv.

Studies have shown that neutrophils utilize trogocytosis for killing Tv [12]. Opsonization by antibodies is essential for neutrophils to kill Tv [12]. CD32a is a neutrophil cell-surface receptor shown to be necessary for the trogocytosis of cancer cells [13]. We hypothesize that CD32a also has an important role in the initiation of neutrophil trogocytosis on Tv.

Results

CD32a Expressed by Neutrophil Like Cells To determine whether CD32a has a role in the trogocytic killing of Tv, we first performed an antibody staining of NLCs. We stained NLCs with anti-CD32a antibody or the IgG2b isotype control. The antibody and isotype control contains a FITC fluorescent marker, which determines the amount of signal we receive, which indicates the amount that the protein is expressed, with a flow cytometer. We stained both cell lines to determine which cell line (HL-60 or PLB-985) expresses more CD32. The data confirms the presence of CD32 expression on both cell lines (Fig1A). We also show the mean fluorescence intensity (MFI) of triplicate samples (Fig 1C). The data show that PLB 985 had significantly higher MFI compared to HL-60 cells, which indicates that the cell line PLB-985 expresses more CD32a than HL-60 cell line. Therefore, we were able to conclude that PLB-985 would be best to knock out CD32a. Designing guide crisprRNA for CRISPR/Cas9 Having confirmed that CD32 is expressed on NLCs, we then designed our knockout strategy.
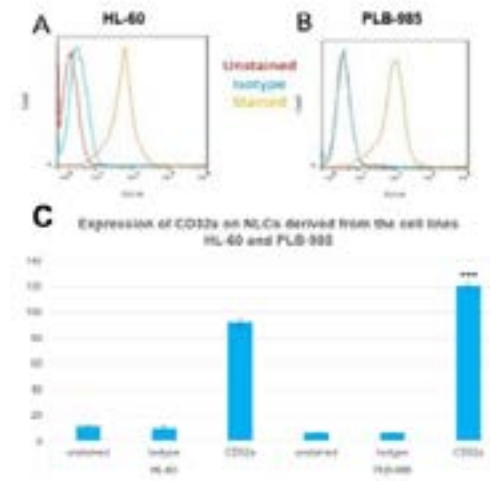
Figure 1 Expression of CD32a on differentiated NLCs derived from cell lines: Figure 1A show the expression of CD32a based on the amount of fluorescence present. Both cell lines were stained with CD32a antibody. The controls included unstained cells and cells stained with an isotype control. Both cell lines express CD32a. Figure 1c is the mean fluorescence intensity (MFI) of each condition in each cell line. The error bars were determined based on standard deviation. We compared the average MFI of HL-60 and PLB-985,and determined a significantly higher expression of CD32a in PLB 985 (P value: 0.000248).

Figure 2 Designing a knockout construct: This cartoon is a representation of the CD32a amino acid sequence and the location of the target CRISPR RNA (crRNA) sequences. Inside the figure, there are two areas that represent 2 Ig domains (green and yellow) important for the function of the CD32a. The colored lines below the sequence (blue, teal, and pink) represent the target crRNA we designed. The colored sequences chosen will be our target area where we used CRISPR(cas) to make a cut and knockout CD32a.

Using the NCBI website, we found the two Ig domains in the CD32a gene. The Ig domains are important because they are where CD32a binds explicitly to antibodies. We then designed seven crRNAs, using E-CRISP.org and idtdna.com, targeting CD32a before or within the Ig domains. We aim to create a mutation before or within the location of the domains so that we can disrupt the function of the Ig domain, and antibodies will not be able to bind to CD32a.

Inhibiting downstream signal of Fc-receptor and antibody interaction in NLCs leads to a decrease in Killing of Tv We labeled NLCs with a dye called Vybrant-Orange. Tv was labeled using the dye Cell-Tracker Green.

We cocultured both NLCs and Tv together at different ratios. Then, we counted the populations of the NLCs and Tv using the flow-cytometer. We created gates around the population of live cells and the Tv population using software FlowJo to determine the which inhibits the downstream signal protein called SYK. When the protein is inhibited, there will be no signal triggered within the cell. Figure 3 compares the killing of the different ratios of NLC to Tv and the difference of killing in the presence of the inhibitor or the presence of a control. This data is important because it shows which ratios are optimal for killing Tv. With this information, we now have the best ratios and conditions when we perform the trogocytosis assay. The data also shows a decrease in neutrophil killing of Tv in the presence of the inhibitor. This supports our hypothesis that Fc-receptors are important for the killing of Tv.
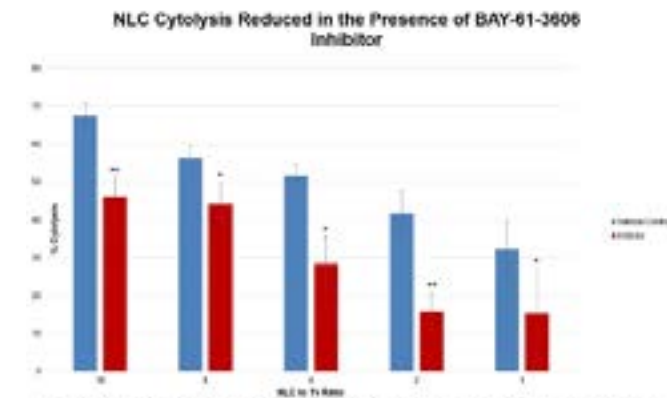
Figure 3 Measuring killing of Tv by NLCs in Presence of SYK Inhibitor: For the cytolysis assay, NLCs and Tv were dyed and then cocultured together. Then, cells were run through a flow cytometer to measure cell killing. The blue bars are the vehicle control that were incubated with the vehicle DMSO. The red bars contained the SYK kinase inhibitor, BAY-61-3606. Both conditions of NLCs were incubated for 30 minutes prior to coculture. The significance of the decrease in the killing of Tv was found by performing a T-test on the percent cytolysis values. We found the value for ratio 16, P value= 0.00396, ratio 8 P value= 0.02083, ratio 4 P value= 0.00873, ratio 2 P value= 0.00210, ratio 1 P value= 0.050526.

Antibody staining of CD32a knockout cells

We took the mean fluorescence intensity (MFI), indicating CD32a expression, and found that the condition with the least expression was oligo #3. Figure 5A shows a bar graph with the MFI of crRNAs #1,2 and 3. In Figure 5A, we see that the cells that received RNP with crRNA#3 had a significant reduction of CD32a expression. The decrease in expression indicates that these cells likely received the CD32a knockout. In Figure 5B, we did an antibody staining of cells transfected with one of the crRNA#4, 5, 6, and 7. In Figure 5B, we see a reduction of CD32a expression in cells transfected with crRNA#4 and #7(possibly). We designed an HDR cassette after determining which of our crRNAs led to a successful knockout or knockdown of CD32a. We then transfected our cells and did another antibody staining to determine if CD32a was knocked out. We then took those cells and performed a functional assay to determine if Tv killing was affected by the chosen crRNAs from the antibody staining.

Figure 4 Antibody Staining of Cells after Transfection: After transfecting our cells with the RNPs that contained our oligos, we performed an antibody staining. First, we differentiated the cells, then we stained the cells with anti-CD32a, and the control cells were stained with an IgG2b antibody. The x-axis are the different conditions, and the y-axis is the mean fluorescence intensity (MFI).

Cytolysis Assay with CD32a Knock-out Cells Show a Decrease in the Killing of Tv
After the cytolysis assay, we found some reduction of Tv killing by NLCs that had a successful CD32a knockout. Figure 5 shows that there was a slight difference between our control group and our samples. The percent of killing was slightly reduced in most of the conditions. We also see that there may be more killing from our second clone of crRNA3b than 3a. Although this data is preliminary, it is very promising. I hope to replicate these results soon and confirm my hypothesis that CD32a has a significant role in the killing and trogocytosis of Tv.

Figure 5 Cytolysis Assay with CD32a Transfectant: After a single cell dilution, we chose 2 clones that appeared to have a complete CD32a knockout. The NLCs and Tv were dyed with two different fluorescent dyes and then cocultured together. We ran the cells through a flow cytometer to measure cell killing of Tv. The dark blue bars represent the cells that had control crRNA, the red represent the transfectant clone A, and the light blue bars represent the transfectant clone B. The following are the P values for clone A; ratio 16 P value= 0.0058, ratio 8 P value= 0.00213, ratio 4 P value= 0.0094, ratio 2 P value= 0.04596, and ratio 1 P value = 0.0772. The following values are the P values for clone B: ratio 16 P value 0.07633, ratio 8 P value = 0.04222, ratio 4 P value= 0.01389, ratio 2 P value= 0.02158, ratio 1 P value = 0.0609.

Discussion

The protozoan pathogen causes the sexually transmitted infection trichomoniasis Trichomonas vaginalis[1]. Trichomoniasis affects 300 million people worldwide[1,2]. Trichomoniasis infection causes different symptoms, but the infection can also be asymptomatic[4]. The infection can be treated with the antibiotic metronidazole[5]. It is thought that that the immune system clears trichomoniasis through neutrophil trogocytosis[12]. Neutrophil trogocytosis is a process of a neutrophil taking small bites out of a neighboring cell[12]. In this study, we aim to understand the mechanisms neutrophils use for trogocytosis of Tv.

The process of neutrophil trogocytosis is activated by antibody opsonization[12]. The method of neutrophil trogocytosis of cancer cells is also activated with antibody opsonization[13]. For antibody opsonization to occur in neutrophils, the Fc portion of an antibody interacts with an Fc receptor on the surface of neutrophils[14]. It was shown that when Fc receptors are blocked using blocking antibodies, the neutrophil trogocytic activity on cancer cells significantly decreases[13]. A specific Fc receptor with a significant decrease in neutrophils' trogocytic activity on cancer cells when blocked was CD32a[13]. We hypothesize that the Fc receptor CD32a will also decrease the trogocytic activity of neutrophils on Tv. To understand the role of trogocytosis, we ceased the expression of CD32a using the CRISPR/Cas9 system, and we observed the effects of neutrophil killing of Tv on cells that received the CD32a knockout. We did this by creating a knockout strategy using an RNP. We then determined CD32a expressed after transfecting our cells by performing an antibody staining with the transfected cells. Once we determined the cells that had a complete or significant knockdown of CD32a, we performed a cytolysis assay to determine if the ability of neutrophils to kill Tv.

Due to the short lifespan of neutrophils, we used a cell line of promyelocytic cells. This includes HL-60 cells and PLB 985 cells. We differentiated our cells with differentiation reagents DMSO and G-CSF. We then stained our cells with an antibody with a fluorophore and ran our cells through flow cytometer. We found that when cells are differentiated into NLCs, both cell lines express CD32a. We calculated the MFI of our data and found that NLCs differentiated from PLB 985 express CD32a more than NLCs differentiated from HL-60. We used PLB 985 cells for the rest of our projects.

We wanted to confirm that Fc receptors were important for the killing of Tv by neutrophils. We did this by performing a cytolysis assay. Before coculturing NLCs and Tv, we incubated NLCs with an inhibitor for a downstream Fc signaling protein called SYK kinase. The reagent that blocks SYK kinase is called BAY 61-3606. As shown in Figure 3, there was a significant decrease in cells incubated with the BAY 61-3606 inhibitor compared to the cells that were incubated with our control, DMSO. This preliminary data supports our hypothesis that Fc receptors are important for the neutrophil killing of Tv . However, we need to replicate our results before confirming that Fc receptors are important for the NLC killing of Tv.

To design our knockout strategy for CD32a, we used ECRISP.org. We found that CD32a had two functional domains. Our goal was to find a sequence before the domains or between one of the first domains. We found about seven crRNA sequences that we were able to order and transfect into cells in an RNP. After transfecting RNPs into our promyelocytic cells, we performed an antibody staining. Our preliminary data showed a significant decrease in CD32a expression in RNP that had crisprRNA #3, 4, and 5. There are possible reasons as to why there is not a complete knockout of CD32a. We suspect that the CD32 anti-human antibody is not specific to CD32a but can also bind to CD32b/c. However, in data not shown in this paper, we found that CD32b/c are lowly expressed and are not the cause of the remaining expression in our CD32a transfected cell.

We then performed a cytolysis assay with cells that contained the crisprRNA#3 knockout. We found less killing in cells that received the crisprRNA #3 knockout versus control cells. This indicates that while the killing was not completely diminished, CD32a must play a role in the killing of Tv. After replicating our results, we hope that we will be able to confirm our hypothesis. We hope that designing our RNPs so that our cells can use HDR to create a mutation will lead to a complete knockout of our cells. Because our previous method of transfecting cells with a plasmid resulted in cell death and did not result in a successful knockout, we tried to knock out CD32a using the RNP method. We were hopeful that using an RNP would allow us to have more successful knockouts and give our cells a better chance of surviving transfection. After trying the RNP method, we noticed that there was still some expression. This could be because not every cell is different may use nonhomologous end-joining in fixing the cell. Using the HDR method would decrease variability between cells and give us a more consistent knockout.

After designing our HDR donor oligos, we hope to transfect the newly designed RNP into our cells and have a more efficient CD32a knockout. After we confirm CD32a knockouts, we will use our transfected cells for functional assays. We expect to see a complete or significant reduction in the neutrophil killing of Tv. We also hope to optimize the trogocytosis assay to observe the effects that CD32a knockout will have on NLC ability to trogocytose Tv, where we would expect to see a less efficient or complete stop of NLC trogocytosis.

Although our data is preliminary, we expect to replicate our results, supporting our hypothesis that CD32a has a role in the killing and trogocytosis of Tv. We hope that our findings will lead to a better understanding of how the immune system clears a Trichomoniasis infection and contribute to a prevention treatment for trichomoniasis in the future.

Material and Methods:

Culturing and Differentiating Promyelocytic Cells

Dr. Sean Collins provides the cell line we use at the University of California, Davis. The cells are stored in cryovials in a -80C Freezer. To thaw and culture promyelocytic cells, cells must have split them every three days with complete RPMI media. Complete RPMI media contains 10% RPMI with HEPES, 10% Fetal Bovine Serum,

1% Glutemax, and 1% pen/strep. The cells are passed every three days at a concentration of 0.2 million cells/ml.

To differentiate promyelocytic cells into NLCs, we must differentiate them. The reagents 1.3% DMSO and 100 ng/ml of C-GSF are added to RPMI to complete the media. It takes 6 to 7 days for promyelocytic cells to differentiate into NLCs and be ready for experimental use.

Culturing Trichomonas vaginalis

To culture the strain G3 of Trichomonas vaginalis, the cells are passed in complete diamonds media. . Tv is stored in a -80C freezer. To make diamonds media, tryptose, yeast extract, maltose, cysteine, ascorbic acid KH2PO4, and K2HPO4 are added to ultrapure water. Iron solution is then prepared with Fe(NH4)(SO4)6H2O and 5-Sulfosialicylic acid. The iron, heat-inactivated horse serum, pen/strep, and tet/chlor to culture the cells are combined. Tetracycline and chloramphenicol (tet/chlor) are added to media to prevent the growth of mycoplasma. The day before using Tv for experiments, complete diamonds media without tet/chlor is used, as these antibiotics can decrease the growth rate and may lead to Tv death. When passing Tv daily, 6 tubes are made with 4ml, 2ml, 1ml ,0.5ml, 0.250ml, or 0.125ml of parasites. The tubes are completed to 15ml with complete diamonds media.

Antibody Staining NLCs

In a 96 well plate, 100,000 NLCs per well were added to a 96-well V-bottom plate. The cells are spun down at 300G for 5-10 minutes. A stock of antibody master mix is prepared. The master mix is prepared with antibody or isotype control so that it is in a concentration of 1µg/ml and is diluted with FACS buffer. We decant the cells and resuspend them in 25ul of master mix solution. The cells are left to incubate on ice in the dark for 30 minutes. The cells are washed with 250 µl of FACS buffer and spun down the cells once more. We decant the cells and resuspend cells in 200ul of FACS. The data is analyzed with flow cytometry.

Generating the Knock-out Ribonucleo Protein Complex

To knockout CD32a in cells, target crisprRNA was designed. Using the ECRISP. org and idtdna.com websites, we found seven crisprRNA. The crisprRNA must be found within or before a domain. This is important to make sure that the translocation of CD32a is stopped. Using the idtdna.com website, we created an HDR donor oligo. The HDR oligo has two flanking sequences on both sides of the crisprRNA, about 40 bp long, and it must be within the same exon that the crisprRNA.

Cytolysis Assay to observe NLC killing of Tv

To begin, Tv is stained with Cell Tracker Green Dye (FITC). A tube of Tv was chosen with a small pellet and significant growth. The tube was spun down in a centrifuge at 3200 rpm. A tube of diamonds media without horse serum and with 0.4 µl of dye was prepared. Tv is resuspended the cells in the media with the dye and incubated them for 30 minutes

at 37C. After incubation, the cells are spun down once more and resuspended the cells at 15ml of complete media without tet/chlor. The cells are left to incubate for at least 45 minutes. After 45 minutes, Tv concentration was determined, and calculations were made to determine we found the cell count of Tv and found the volume of Tv to spin down the cells, so the cells are at 15,000 cells. Tv so that we have 50 µl per condition. The cells are ready to coculture.

To stain NLCs, the cells are spun down the cells at 100G for 10 minutes and resuspended the cells in complete media that contains 2.5 ml/10 ml of PBS and 0.5µl/10 ml of CTDR. The cells are incubated at 37C for 15 minutes. The cells are spun down once more and are resuspended in complete media at 50 ml. The cells are then counted resuspended in enough media so that there are 240,000 cells/condition. The cells are placed on ice until ready to coculture.

To assemble the plate, 10µl of human antibody serum is added to each well, RPMI is added to have a volume of 110µl total. NLCs are added by titrating down by half, starting at the ratio of 16:1 NLCs to Tv. 50µl of Tv is added to each well except in an NLC alone condition. The complete coculture is incubated for 1 hour, and the samples are analyzed on flow cytometer.

To add the SYK kinase inhibitor, BAY61-3606, at a concentration of 10µM/ml. The inhibitor is diluted to 100µM/ml with RPMI. The 100µM/ml inhibitor solution is then diluted once more in the plate so that the final concentration is 10µM/ml. The inhibitor is added before adding Tv and incubated for 20-30 minutes. After 20-30 minutes, Tv is added to the coculture and then incubated for 1-2 hours.

To fix cells, the same amount of volume of paraformaldehyde to the wells as the final volume of the cells. The cells could be run through a flow cytometer up to a week after they have been fixed. The data can be analyzed through software such as FlowJo.

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Powers Brian   **Gramsci and Marx**

Abstract

In this paper I seek to illustrate the points of commonality and separation between the politico-philosophical views of Karl Marx and Antonio Gramsci. I analyze their ontology, epistemology, metaphysics, and social and economic theory. I conclude that Gramsci represents a moderate divergence from Marx's views on the basis that they disagree on realism, positivism, and civil society; I also acknowledge their similar positions on the indeterminate nature of historical progression, the centrality of the law of value for motivating change, and the use of qualitative data on matters of social inquiry.

"Everyone is a bit of a Marxist, without being aware of it" (Gramsci, 2000a). One may not think that they believe in the tenets of historical materialism, or that they spend their lives engaging in revolutionary praxis, or that they need to carry a little red book and flash a hammer and sickle to their fellow comrades on Tuesday theory nights in order to be a card-carrying, capitalism hating, "big C" Communist. And such a belief is justified. Most people have not read Karl Marx. Many are unfamiliar even with his name. And yet, everyone—in some way!—is a Marxist.

The Marxist paradigm is so obvious that many once-controversial views are now taken for granted. The idea that unfettered capitalism produces an unequal distribution of resources over time is one that mainstream economists such as Thomas Piketty are enthusiastic to assert (Mason, 2014). The fact that material conditions influence the behavior of humans in its most unsophisticated interpretation is what many would consider to be a truism.

Like Marx, everyone has a bit of Antonio Gramsci in them as well. The idea that political movements must consolidate power amongst a significant portion of individuals in the form of ideology in order to survive is one that any serious theoretician will acknowledge.

Both individuals are towering figures in the fields of social philosophy and science. The former is known for his political influence as manifested in Marxist-Leninist movements across the world, influencing twentieth-century politics to a degree that history would be unrecognizable without his beliefs (Wolff & Leopold, 2021). The latter is known more strongly in academic circles, presenting an eminence in the fields of cultural and post-colonial studies, critical theory, and international relations—with some moderate influence on so-called "Eurocommunist" political movements (Anderson, 1976; Patnaik, 2013).

Such a close-knit association of influence, at first glance, makes perfect sense. Gramsci himself was an avowed Marxist (or Neo-Marxist, depending on whom is asked) and framed his works as existing in the space of dialectical theory.

An enigma arises, however, when one considers the simultaneous influence of the two figures. If Gramsci is simply another Marxist, how can it be that he is also so influential? Is it merely the case that Gramsci is using the principles established by Marx and solving problems in the same framework? Is it so that Gramsci represents a simple extension of Marx's writings? Or is there something more to his thought that justifies such a strong resonance in academia? And did they find differences in their conclusions if such is the case?

This question may intuitively seem superfluous and obtuse. Who cares about the potential intellectual squabbles of one Italian criminal who spent half of his life in a fascist prison and a stateless German-born *slob* who rarely bathed, cleaned his room, or held a job—all while relying on the money of a bourgeois factory-owner, whose class he swore to criticize relentlessly (Jones, 2010, p. 24)? Surely, this is the typical beer-battered-and-fried dispute where dead, white, male philosopher 1 holds "obscure-view-of-no-consequence" X and dead, white, male philosopher 2 holds "obscure-view-of-equally-no-consequence" Y. Tasty, surely, but of no nutritional value. And certainly no contribution to any epistemic fitness.

The reality is that establishing differences in their respective philosophies can shake misconceptions of *both*. This could have the potential to correct so-called "eternal" models of social interaction based on their theories. Misinterpretations of Gramsci that *further misinterpret Marx* could be the foundation for longstanding flaws in *all* of the fields of inquiry previously cited. If Neo-Gramscian international relations perceives the "theater of history" in civil society—a concept based on Gramsci's definition that *supposedly* draws from Marx—what are

we to believe if Gramsci *actually* draws it from Hegel? What if established traditions in social studies are, in fact, *fallaciously conflating their most eminent influences?*

Research Question Statement

How much of a divergence from Marx's views and orthodoxy, if at all, does Gramsci represent?

Thesis

Gramsci represents a moderate divergence from Marx's views and orthodoxy.

I will establish that there are both nominal and substantive differences in the core beliefs of Gramsci and Marx, while also defending some key similarities held between them. I will begin generally from the most fundamental topics (ontology and epistemology) and work up to more complex issues (philosophy of science and dialectics) when illustrating the difference between the two philosophers.

Methodology

It is necessary to define my methodology before I develop my argument further. I will define my terms, explain which sources will be considered legitimate, and establish the conditions for a successful thesis.

Term Definition

Moderate Divergence. When I write that there is a "moderate divergence," I am referring to Gramsci's and Marx's works *at large*. I am referring to their stated positions broadly across their respective philosophies. I define a "moderate" divergence as *any* disagreement between what I identify as "core beliefs." If I find a *"significant difference"* between two core beliefs, then I will consider my thesis satisfied. I hold that there is not one, but *several significant*

differences between the core beliefs of Gramsci and Marx, satisfying the criterion of a *moderate divergence* at large.

Significant Difference. When I write "significant difference," I define this as philosopher 1 having position X and philosopher 2 *not* having position X. I do not define a significant difference as a philosopher having the *opposite* position—Gramsci does not need to be an idealist to represent a significant difference from Marx's materialism; rather, a significant difference is simply a view that is not essentially identical on the basis of the comparison.

Orthodoxy. I also use "orthodoxy" in several ways. When I refer to something as an "orthodox" view, I am not necessarily referencing Orthodox Marxism. I am not referencing the codification of Marx's views and unclear aspects of Classical Marxism proper. I will not dedicate time to defining the specific positions of what Orthodox Marxism is, but I will reference it throughout the paper occasionally. More broadly, when I call a position "orthodox," I am referring to Marxist literature that historically has not been considered revisionist, Neo-Marxist, Post-Marxist, or to have otherwise changed "fundamental tenets" of Marxism.

Legitimate and Illegitimate Sources of Information

I have specific conditions for what constitute a philosopher's "views." If I were to ask the average person whether they think their current or their future views will represent them more as a person, it is reasonable that most would prefer their views at their most "mature" to represent them. I hold this principle to both Marx and Gramsci, although it clearly applies more specifically to Marx. Therefore, if there is a substantial difference between earlier and later publications, I will seek evidence from the "mature" works of Marx. If there is no significant difference of opinion between "young" and "mature" works, then I will presume it acceptable to use any time period for evidence. If a position is found in Marx's early works that is implicitly

incompatible with later frameworks, then I will presume that it does not constitute a view of Marx proper. As an example, the term "species-being" is used in Marx's "humanistic" writings but never again in later ones. I will disregard it without elaborating upon why I believe it to be incompatible or irrelevant to the mature works. Such a practice will promote brevity in this analysis and undoubtedly contribute to an easier reading. If a position by Marx cannot be found in the mature works but is still compatible with their suppositions, then I will refer to the latest exposition of relevant views.

One will find that I draw heavily from *The German Ideology*, even though this arguably represents a "transitionary period" between the young and mature Marx. This is because it is the clearest presentation of many of Marx's positions that are still relevant to his later analyses. Relatedly, much of Gramsci's positions are based on interpretations of the *Ideology*. While this may not suffice as a reason in itself to take the *Ideology* as gospel for Marx's ultimate positions, this justifies its citation for contextualizing *Gramsci's* views.

Indications of a Successful Thesis

I believe that one can emphasize different facets of the Marxist worldview as being "more essential" in valid ways when establishing which are to be considered "core beliefs." As an example, one could argue that praxis as an epistemological condition for the truth value of a theory functions as the condition for whether someone could be considered a Marxist. This is a perfectly valid view to me. However, I am explicitly not going to be judging whether or not Gramsci is a *Marxist.* Instead, I will focus on whether Gramsci represents a *significant divergence* from Marx's beliefs.

The source of this "significant divergence" will be proven on the basis of analysis of primary texts. If such an undertaking proves to warrant analysis too long for the scope of this paper, or otherwise is too contentious for neat and unambiguous assertions, then I will appeal to scholarly consensus. If scholarly consensus cannot be clearly defined or is absent, then I will simply concede that this divergence cannot be illustrated on that particular issue.

I contend that if I can prove *significant divergence* between one or more core aspects of Marx's views and those of Gramsci, then I will have illustrated a greater representation of significant divergence between them overall. I will briefly reconstruct a broad overview of Marx's beliefs. Then, I will analyze each philosopher's views on each topic in more detail. In the process of doing so, I will define Marx's core principles. Then, I will compare and contrast them with Gramsci's. Finally, I will reiterate my affirmation that Gramsci represents a significant divergence from Marx's views.

On Reconstruction

I will reconstruct their beliefs for two reasons. Firstly, reconstructions are helpful for those unfamiliar with the topic and provide much needed context for technical language. Secondly, reconstruction allows the experienced reader to understand my individual interpretation of the respective philosopher's principles. This allows them to judge my argument on the merit of the logic used in my reconstruction. One might otherwise dismiss my argument on the basis of a subjective difference of interpretation of the subject.

Brief Reconstruction of Marx's Beliefs

Marx presupposes realism, determinism, ontological materialism, and naturalism. Marx's epistemology requires that theory be either confirmed through or founded upon practical application and empirical observation in the lens of a "positive" science. These are the principles that precede his analyses of history as seen in his "mature" writings.

Karl Marx summarizes his views in the famous *1859 Preface to a Contribution to the*

Critique of Political Economy:

In the social production of their life, men enter into definite relations that are

indispensable and independent of their will, relations of production which correspond to a

definite stage of development of their material productive forces. The sum total of these

relations of production constitutes the economic structure, the real basis, on which rises a

legal and political superstructure. (Marx, 1978d)

Marx, in his writings, constructed a philosophy and method of analysis that posits the

existence of a "structure" of society and a "superstructure" that emerges from the structure. The

structure consists of the *relations of production*, which "correspond" to *productive forces*.

Productive forces consist of the *means of production* ("instruments of production," and "raw

materials") as well as *labor power* ("productive faculties of producing agents: strength, skill,

knowledge, inventiveness, etc.") (Cohen, 2020, p. 31). The productive forces, contrary to much

existing Marxist literature and interpretation, do *not* constitute any of the structure. Indeed, the

structure depends on the content of the productive forces, which are a more fundamental

determinant of history that I will refer to as the *infrastructure* or *substructure*. Legal and political

institutions arise from the structure and form the *superstructure*, which largely serves to

reinforce the existing relations of production. I also content that ideology *is* a part of the

superstructure. Thus, the superstructure can be summarized as the ideological, political, ethical,

and otherwise social content of society.

There are further nuances to be found in Marx's explication of the structure. Marx refers

to *civil society* in different forms throughout his oeuvre. In his mature beliefs, he sees it as an

abstraction that actually refers to the relations of production that surround commodity production

and exchange. I will supplement this summary with a more detailed construction in a section

dedicated to this topic.

Therefore, Marx's *core beliefs* to be analyzed, compared, and contrasted with Gramsci's

are his positions on epistemology, realism, positivism, historical necessity, base-superstructure

determinism, and the definition and function of civil society.

With this, I begin my detailed analysis of Marx and Gramsci.

Metaphilosophy through Epistemology and Realism

Gramsci and Marx have radically different views regarding the fundamental nature of

knowledge and ontology. Because these views are the foundation for their other conclusions, I

see these as the logical place to begin analysis. I will first reconstruct Marx's realism and then

contrast it with a reconstruction of Gramsci's philosophical skepticism.

Exposition of Core Beliefs

Marx. Marx sees his beliefs as informed by the absolute conviction that external reality

exists. Philosopher H. B. Acton, in his article "Karl Marx's Materialism," asserted that Marx's

writings "proclaimed that sense experience is the basis of all science." His view is one that is

strongly substantiated with textual evidence. Particularly, he cites a passage from *The Holy*

Family where Marx affirms that sense experience "compels" the individual to "believe in the

existence of the world and the individuals outside him." *The German Ideology* has multiple

quotes that are animated by hatred for ontologically idealist philosophy, calling it "malicious," as

possessing a "parsonical drive for power," and as "charlatanism." The intensity of these

statements is undeniable. Further in *The German Ideology,* he writes of his peers revolting

against the theological roots of Hegelian philosophy; they "attribute an independent existence" to

"conceptions, thoughts, ideas, in fact all the products of consciousness" (Marx-Engels Reader,

153). For the average Marxist, the ontological priority of external reality is a foundational assumption. The literature surrounding Marx's position is unambiguous.

Gramsci. Gramsci firmly denies Marx's assumption that there is an external reality. Not only does he reject the way that the argument is framed—Gramsci characterizes it as "futile and superfluous" (Gramsci, 1971a, p. 440). Gramsci agrees with Marx by asserting that "the popular public does not think that a problem such as whether the external world exists objective can even be asked" (p. 441). While Marx appeals to the idea of authenticity as a point of evidence for realism, the idea that philosophers are being intellectually dishonest because they live their lives as if everything that they perceive is "real," Gramsci takes this to be an *indication* that the belief must be challenged. "What is the origin of this 'belief [in external reality],'" Gramsci asks, "and what critical value does it 'objectively' have?" Marx sees himself as revolting against religious dogma implicitly asserted within Hegelian analysis, as idealists had previously been "subsuming the allegedly dominant metaphysical, political, juridical, moral and other conceptions under the class of religious or theological conceptions" (Marx & Engels, 1978b, p.148). Gramsci attacks the positive assertion of *any* position regarding realism as itself being a part of a religious conception: "The belief is of religious origin, even if the man who shares it is indifferent to religion" (Gramsci, 1971a, p. 441).

It is important to note that Gramsci is developing a critical perspective on this particular aspect of realism, and that he does not necessarily affirm an anti-realist worldview. His particular view is that of a dogmatic skepticism in which both realism and anti-realism are strongly refuted as wholly unknowable. He asserts that "the subjectivist conception," the philosophy of phenomenologists like George Berkeley, both "gave birth to" historical materialism, which then "superseded" it (Gramsci, 1971a, p. 442). For Gramsci, subjective idealism led to the conditions upon which it could ultimately be reacted against. At first glance, this passage seems to imply that historical materialism is the antithesis of the subjectivist conception, in that it must represent a realist perspective. The prudent interpretation of this is that Gramsci asserts a realistic agnosticism in his interpretation of historical materialism. In this way, Gramsci's characterization of historical materialism as an intellectual movement after Marx is a stereotypically dialectical one: subjective ontology (the thesis) sublimates the realist worldview (the antithesis) towards a higher understanding of metaphysics that rejects the very ability of the subject to have knowledge either way (the synthesis).

There are brief moments that appear to contradict this view, though. Gramsci references that the human "masters the secret which lies behind the real unfolding of events" and "acquires awareness of objective reality" when made aware of historical materialism (2000b, p. 33). Gramsci also mentions "objective reality" in other passages of *The Prison Notebooks*. Such a position suggests that even though Gramsci might be neutral towards the existence of an external reality, he still thinks that reality functions according to the philosophy of praxis.

Consolidation of Core Beliefs

Marx.	Gramsci.
1. Objective reality is real.	1. Objective reality is real.
2. External reality	2. External reality
a. is knowable.	a. is unknowable.
b. exists.	b. may or may not exist.
3. One derives the reality of the external world from the mere fact that it is observed.	3. There is no means to derive the existence of external reality.

4. Common sense ideas

    a. must not necessarily be historicized.

    b. can be valid on the basis of popular approval.

5. Those that deny external reality necessarily do so in bad faith.

4. Common sense ideas

    a. must necessarily be historicized.

    b. are not valid on the basis of popular approval.

5. Those who deny external reality can act in good faith.

Analysis of Beliefs

Marx's ontology informs his epistemology. Gramsci inverts this relationship. It may be tempting to say that Marx believes in the external world because he strongly believes that his senses show the world. Such a justification appears to be empirical, but upon further inspection, it actually represents a rationalist strain in Marx's thought. How could Marx justify the accuracy of his senses in representing a consistent external reality without presupposing the existence of an external world to inform them in the first place? When Marx argues that sensation supposedly compels one to believe in the existence of the external world, Marx fallaciously conflates this belief with the claim that senses are *necessarily* correct.

In contrast, Gramsci's skeptic epistemology informs his ontological beliefs. Because he historicizes his beliefs as mere expressions of a dialectic, he is critical of ideas taken to be common sense. To be clear, Gramsci presupposes historical materialism (insofar as he believes that ideology is structured according to a historical process—one that might not exist in some sort of external reality), so he is not devoid of rationalism within his beliefs. For Gramsci, however, his strong historicization of ideology takes precedence even over the belief of an external reality.

On a Positivist Ethos

For this section, I will analyze Marx and Gramsci's respective relationships with positivism. It is necessary to define this term in pursuit of clarity. I define positivism as the idea that philosophy can and should be unified with natural science. One is a positivist if they endorse this view or otherwise express support for positivism.

Exposition of Core Beliefs

Marx. Commentators have expressed that Marx was "consciously and by intention positivist" in his philosophy of science (Acton, 1958, p. 271). Although some Marxist theorists like Herbert Marcuse (2005) cite the *Economic and Philosophic Manuscripts of 1844* as Marx's indebtment to Hegel (perhaps the strongest opponent to positivistic historiography *par excellence*), Acton notes a pertinent passage in *The German Ideology* where Marx and Engels appear to *rebel* against the idealist: "Where speculation ends, in real life, real positive[1] science begins, description of the practical activity and practical evolution of mankind… Philosophy as an independent sphere of knowledge loses its sphere of existence when reality is described." In the Preface, Marx notes that economic conditions "can be determined with the precision of natural science" (1978d, p. 5) Thus, Marx held strongly positivistic inclinations as seen in these quotes.

Gramsci. Gramsci, in contrast, has been considered a strongly anti-positivistic force in Marxism (Kołakowski, 1978, p. 228). Gramsci earns this reputation by critiquing a positivistic interpretation of Marxism found in the Bolshevik *Popular Manual*, a Soviet text used to "educate" the masses (Gramsci, 1971a, p. 425). "What does the assertion really mean," Gramsci

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[1] Note that Marx was absolutely aware of the term "positivism"—he had written about its originator, Auguste Comte, who fully published *The Course in Positive Philosophy* three years before the drafting of *The German Ideology* (Bourdeau, 2022; Acton, 1958, p. 271).

asks, when the *Popular Manual* states that Marxism "is purely a sociology?" In the polemic, Gramsci characterizes sociology as a "so-called exact (i.e. positivist) science," contrasting it with his interpretation of Marxism, which he interprets as a "practical criteria" and as "an entire conception of the world, a philosophy." He goes even further by deeming sociology an "evolutionist positivism" and a "philosophy of non-philosophers." For Gramsci, sociology, in the narrow sense that it is an empirical endeavor that presupposes the constancy of natural laws of human behavior, is a fallacy. Gramsci emphasizes the dialectical nature of metaphysics in contrast to sociology's "mechanical process" (p. 430).

Gramsci further argues against positivist ideology by deeming it unreliable and potentially dangerous. "In the natural sciences," Gramsci argues, "the worst that statistics can do is produce blunders… but in the science of art and politics it can have literally catastrophic results which do irreparable harm" (Gramsci, 1971a, p. 429). For Gramsci, the application of statistics in Marxism presupposes a mechanistic worldview that believes the world moves according to unchanging laws: "the law of statistics as an essential law of necessity," Gramsci continues, "is not only a scientific error, but becomes a practical error in action." Not only does Gramsci *not* call for the unity of the social and the natural sciences, he actively argues *against* the use of statistics to inform praxis. Gramsci argues that the "concept of 'science'" that the Bukharin expounds needs "to be critically destroyed" (p. 438). He says that it has "taken root and branch from the natural sciences… as decreed by positivism." Gramsci defends that the method of the natural sciences has worked in practice *insofar as they have been used in those fields*. It is a "strange delusion," in Gramsci's eyes, to think that one can apply natural science to the philosophy of praxis "because it has given good results in another field of research" (Gramsci, 1971a, 439).

Consolidation of Core Beliefs

Marx.	**Gramsci.**
a. The unification of philosophy and natural science	a. The unification of philosophy and natural science
a. must happen.	a. should not happen.
b. is the only and most useful way to produce praxeological knowledge.	b. may produce useful revolutionary knowledge, but is too risky and can produce catastrophe.

Analysis of Core Beliefs

Gramsci's language about the unification of natural and social sciences clearly differs from that of Marx.

Firstly, they reference "evolution" with entirely different tones. Marx refers to a "practical evolution" of humanity that can be observed through positive science, while Gramsci sees the evolutionism of sociology as anti-dialectical and "vulgar." It could be that Marx is not referring to a genuine metaphysical belief in mechanist history in his statement. Perhaps he is referring to evolution purely as a metaphor for the changing characteristics and circumstances of class struggle. I will prove later that Marx's views on this topic change later in his career. However, at least in *The German Ideology,* it *would* fit with his project of scientific inquiry to accept an evolutionary view of history[2], which Gramsci clearly rejects.

Marx also clearly supports the use of statistics in social inquiry, which Gramsci outright refuses. Marx states that material conditions can be ascertained "with the precision of a natural

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[2] Note that Darwin released *On the Origin of Species* in 1859, nearly two decades after *The German Ideology* was drafted. This is not a reference to Darwinism or evolutionary biology.

science," which would presumably be used to inform the researcher about future conditions. Gramsci dismisses the ability of a subject to construct accurate "predictions."

These ideas make sense when one considers their projects as a whole. It has already been established that they differ regarding realism, and that Gramsci is significantly more skeptical than Marx is about empirical inquiry. So, it follows that Gramsci would extend this skepticism towards statistics. If one merely interprets their "facts" according to the historically contingent paradigm of their times, then it follows that Gramsci would not consider the inquiry to be valid. It also makes sense that Marx, who is reacting against Hegelian mysticism surrounding the future, would want to construct a system defined by precision and certainty. When one analyzes their projects as a whole, their divergences become contextualized.

Empiricism versus Rationalism

Gramsci and Marx have clearly made opposite intellectual commitments to positivism. While Marx sees positivism as necessary for the construction of theory, Gramsci identifies the positivist inclination for statistics (and other quantitative research, likely) as firmly in the domain of natural sciences. How does Gramsci justify having views against positivism that seem to directly contradict Marx's endorsement?

Gramsci's Justification

The answer is never directly stated by Gramsci, but there are kernels of evidence to suggest that he thought that he was expressing a more "authentic" Marxism based on the construction of a metaphysical framework prior to empirical inquiry—I will refer to this as "rationalism." Such a sentiment can be found in a quote briefly mentioned earlier. I will reprint it here in full:

One must however be clear about this: the philosophy of praxis was born in the form of aphorisms and practical criteria for the purely accidental reason that its founder dedicated his intellectual forces to other problems, particularly economic (which he treated in systematic form); but in these practical criteria and these aphorisms is implicit an entire conception of the world, a philosophy. (Gramsci, 1971a, p.426)

Gramsci attributes the philosophy of praxis as being created due to an "accidental reason." But what does he mean by this? There are two ways to interpret this statement:

1. Marx *consciously* constructed a theoretical framework due to purely incidental circumstances. (The "accidental reason" is attributed to the purely coincidental fact that Marx lived in a unique historical and intellectual moment. He initially intended on solving a different problem of philosophy, which resulted in something else and original.)

2. Marx *unconsciously* constructed a theoretical framework that he was not even fully aware of. (The "accidental reason" is attributed to the fact that Marx did not realize the implications of his own statements that he was making.)

I believe that Gramsci is making the latter statement. Notice that, in statement proceeding the semicolon, Gramsci argues that Marx makes claims that apply more broadly to theoretical inquiry. If Gramsci were making a statement about Marx's unique historical circumstances, why emphasize the fact that his "aphorisms" contain "implicit" "conception[s] of the world"? Such a statement provides theoretical justification for Gramsci's apparent deviation from Marx.

According to Gramsci, Marx was not even fully aware of the implications of his own philosophical system. Of course Marx would identify so strongly with positivism towards the unity of the natural sciences and the social sciences. Marx could have simply not been aware of

the contradictions within his own thinking. Although, this assumes that Gramsci even thinks there are contradictions in Marx's thought. Many of Marx's references towards affirming positivism are found in *The German Ideology*, which was published in 1932. Gramsci's 1926 prison sentence meant that he would not have had access to the text (Rehmann, 2013, p. 118).

An alternative interpretation of Gramsci is that must be denied is that he would not think of Marx's "unity" of natural and social sciences as being a positivistic endeavor. Note that in the above quotations, Gramsci argues against the use of statistics in the social sciences. We have established that such a view stems from the idea that statistics is not sufficiently "dialectical," or that it fails to account for the capacity of the subject to change from passive to critical. Could it also be so that Gramsci believes that the unity of social sciences and natural sciences consists of "correcting" the natural sciences to be more "dialectical"? Perhaps not, since he seems to affirm its efficacy when he refers to natural sciences as having "given good results" with a method that "was naturally suited" for it (Gramsci, 1971a, p. 429). It does not seem likely that Gramsci is not making a metaphysical statement when he denounces having a "mechanistic" worldview; he only validates the use of such a methodology on the basis that it is practical in that specific field.

Exposition of Core Beliefs

Marx.	**Gramsci.**
Marxism does not contain a conception of the world before it analyzes history.	Marxism contains a conception of the world before it analyzes history.

Concluding Remarks

Regardless of the justification, however likely it may be, the language between the two radically differs. Gramsci's radical skepticism towards both the empirical validity of his senses

and towards his own common assumptions as being based in historical contingency stands flat in the face against Marx's own positivistic rhetoric.

Methodology through Qualitative Data and Value

It has been established that Marx and Gramsci significantly diverge on their stated commitments to positivism. Their methodology is more complicated. They are inclined to justify social phenomena based on things that are not directly quantifiable. Therefore, I believe that Marx and Gramsci are mostly similar insofar as they largely use qualitative data. Specifically, I argue that the law of value ultimately betrays a qualitative dimension to their philosophies.

The tasks I set out to prove this point are as follows: explain how Marx does not use quantitative data for most of his theoretical work, note the ambiguity of the law of value as a quantitative principle, and illustrate how Gramsci follows in the footsteps of Marx's qualitative and theoretical inquiry.

Exposition of Core Beliefs

Marx. When Marx constructed the framework of historical materialism, he gave few ways to measure its constituent parts quantitatively. In his *1859 Preface*, Marx states that there are "relations of production which correspond to a definite stage of development of their material productive forces." (Marx, quoted in Cohen, 2000). Marx does not give a way to properly quantify most of these terms[3]. When he refers to the increasing "division of labor," the specialization of tasks that supposedly increases with economic development, Marx does not observe this numerically (Marx, 1978b). He does not compare historical data from 1850 that states that the average textile sweatshop contained five different roles to data from 1855 where those sweatshops had grown to incorporate eight specialized roles. He does not find a "rate of

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[3] Technically, the relations of the production can be partially defined in terms of the extraction of surplus value by the capitalist from the proletarian. I will elaborate later why this model relies on qualitative data.

specialization." His observations may be empirical, insofar as they require experience, but the base–superstructure framework alone does not lend itself towards numerical data.

The so-called "quantitative data" that Marx uses in his economic analyses are frequently not directly observable, or ultimately are justified using qualitative data. In volume I of *Capital*, Marx hypothesizes that, in the case that twenty yards of linen are worth the same as one coat, they are valued at the same (1978a, p. 304-305). He uses this as the foundation for his law of value, which is an essential part of his primary critique of capitalism centered around its necessity to extract surplus-value. He postulates that the reason for equal valuation of the commodities is due to the equal "socially necessary labor time" put into them[4] (Marx, 1978a). But how are we to observe what kind of labor time is "socially necessary", based on what are to be considered "normal conditions of production." How does one measure those without resorting to qualitative methods? Clearly, this is ultimately irreducible to quantitative data.

Gramsci. I have established that I consider the law of value to be (at least partially) qualitative, and I assert that Gramsci uses it as a foundational principle for his philosophy. Contra theorists that handwave Gramsci's Marxist economic commitments, Joel Wainwright notes his several approving comments towards Marx's "critical economy" (2010). Gramsci refers to Marx's theories as being an "enrichment," noting the positive connotation of the word as expressing approval (as cited in Wainwright, 2010, p. 620). He argues that Gramsci "follows Marx not only methodologically but substantively" because of his "abiding interest in the three volumes of Marx's *Theories of Surplus Value*" (p. 621). This statement additionally bolsters the earlier arguments I made in the methodology section. Gramsci's own words would affirm such a view from his "Unity in the Constituent Elements of Marxism," where he writes:

_____
[4] Marx does not explicitly say so in the passage, but he assumes that supply and demand are at equilibrium here, thereby not distorting the price.

Unity is given by the dialectical development of the contradictions between man and matter (nature-material forces of production). In economics the unitary centre is value, alias the relationship between the worker and the industrial productive forces (those who deny the theory fall into crass vulgar materialism by posing machines in themselves-as constant and technical capital-as producers of value independent of the man who runs them). (Gramsci, 1971c, p. 402)

Wainwright takes this as a strong piece of evidence in his favor that Gramsci thought that the law of value was an aspect of his beliefs. Wainwright notes that Gramsci's "parenthetical critique underscores his emphasis on value for understanding social relations" (2010, p. 621). Those who "fail to see that surplus value derives from labor are," in Wainwright's reconstruction of Gramsci, "charged with, of all things, *vulgar materialism*."

Gramsci also lacks quantitative data when describing the causes of the Bolshevik Revolution. Gramsci does not cite the lower yield of crops that preceded the revolution. He does not note a 20% decrease of prices of grain and argue that this puts the peasantry at critical revolutionary levels. Gramsci merely cites "Russian propaganda" in his analysis as a contributing factor to the Bolshevik revolution while gesturing vaguely towards unique economic circumstances (2000b, p. 33).

Gramsci's justification for this type of qualitative analysis is found in his interpretation of Marx. "With Marx," he argues, "history continues to be the domain of ideas… they are no longer fictitious religious or sociological abstractions" (Gramsci, 2000a). Using Marx's idea of *class consciousness*, Gramsci argues that revolution happens when the "flock acquires awareness of itself," or, whenever a class understands the "objective reality" that it is situated in. These statements could be true, but they are a far cry from the type of inquiry found in physics by

measuring length or force. It is near impossible to quantify the states Gramsci describes. Does one survey a population and ask how high they are on the "class consciousness scale"? Would such an approach even produce accurate results? Clearly, these are more than enough examples to illustrate the highly qualitative nature of Gramsci's inquiry.

Consolidation of Core Beliefs

Marx.	Gramsci.
Qualitative data can and ought to be used to explain social behavior.	Qualitative data can and ought to be used to explain social behavior.

Analysis of Positions

It is clear why Gramsci does not follow through with quantitative research. To him, history is not governed by "so-called laws" of the "economic structure which directly determines political activity" (Gramsci, 2000c). Gramsci has no need to develop quantitative data because the mere state of the economy does not produce revolution. Why focus on passive observation instead of actively involving one's self? What good does a number do when it cannot be used as a predictor for the inherently unpredictable actions of a conscious proletariat?

Explaining Marx's behavior is more difficult. Upon Marx's death, Engels found multiple cubic meters of papers solely dedicated to "Russian statistics" (McLellan, 1973, p. 422). It has been established that Marx considered himself to propound a so-called "positivist" worldview. He clearly found external reality to be undeniable, as justified by his empirical faculties. Why not use the quantifiable data that this world presents?

Marx, like Gramsci, found it necessary to look beyond appearance to find theoretical conclusions. Even though Marx identified with unifying the natural and social sciences, he still criticized Hegel for having an "uncritical positivism." Marx also stated that "science would be superfluous if the outward appearance and the essence of things directly coincided" (as cited in McLellan, 1973, p. 43). McLellan notes that in the "traditional works it was noted how Feuerbach, Stirner and Proudhon were criticized" for their abstraction. And, yet, abstraction remains "one of the most prominent themes of the late works as a whole" (p. 45). Marx criticizes the idea of seeing reality as "conflict free," and for reifying observations about the world into inherent essences of humanity. For Marx, assuming that contemporary economic facts elucidate eternal truths is a "crass empiricism" (p. 42). Such a mistake constitutes a critical rejection of the political economists that preceded him. It appears that Gramsci, in this respect, has a defensible interpretation of Marx, since both are skeptical of the initial appearance of decontextualized economic stats.

Interestingly, McLellan's comment about Marx's "transitional works," traditionally seen to include the *Theses on Feuerbach* and *The German Ideology,* are the passages most strongly cited for Marx's endorsement of positivism. It could be that Marx's views evolved against positivism in his more mature works; regardless, his later position is not clarified, and it is uncertain whether he thought differently about unifying the natural and social sciences. Gramsci could have thought that Marx moved past this view, though it should be noted that some scholars assert Gramsci was never able to read *The German Ideology* (Rehmann, 2010, p. 118).

We conclude that Marx and Gramsci adopt similar methodologies when reaching their theoretical conclusions. They heavily use abstraction while disregarding "crass" empirical (quantitative) inquiry. They incorporate the law of value, a principle that cannot be reduced to quantitative data, in their respective works. In this respect, they are remarkably similar.

Historical Determinism

Marx and Gramsci likely did not significantly depart from each other on historical necessity. I will begin this section by defending the thesis that Marx did not, in fact, believe in capitalism as a necessary stage of *evolutionist* development.[5] I will then compare this with a reconstruction of Gramsci's belief in the indeterminacy of historical progression.

Exposition of Core Beliefs

Marx. The fact that Marx believed in historical necessity is uncontestable in the majority of his writings, including those of his "mature" works. There are numerous references to "natural laws." In the *Economic and Philosophic Manuscripts of 1844,* Marx writes about deleterious effects of capitalism as "necessary, inevitable and natural consequences" (Marx, 1978c). Marx also states that the "philosophical and the political development" of Germany is "an inevitable disparity" (Marx, 1978a). Passages from *Capital* and the *Grundissse* also affirm this (the "natural laws of capitalist production" have "tendencies working with iron necessity towards inevitable results"; "when the working class comes into powers, as inevitably it must") (Marx, 1978a). Of course, there is the famous line of the *Manifesto* in which Marx proclaims that the "fall" of the bourgeoisie "and the victory of the proletariat are equally inevitable" (Marx & Engels, 1978a, p. 483).

Some have argued that Marx is merely using the language of some of these quotes as a political rallying cry rather than an overt statement of theory (Cohen, 1986). Such an argument may be more compelling in a text like *The Manifesto*, which was only intended to briefly schematize the principles of historical materialism in the context of a party programme. The argument fails to hold any weight, however, when one considers the considerable size and length of *Capital;* it seems significantly less plausible that Marx would have digressed from his theory in such a focused analysis of capitalism.

I contend, in spite of this literature, that Marx's language sharply changed near the end of his life. Some theorists have asserted the lack of faith that Marx had for Russian revolution due to the lack of technological and economic development enjoyed by a semi-feudal state (Jones, 2010, p. 30). And yet, Marx's own language appears to shift after initial apprehension: "historical inevitability" of peasant abolition in favor of proletarian development is only limited to "the countries of Western Europe" (Marx, quoted in Shanin, 1983, p. 100). Marx, according to Marxist historian Teodor Shanin, believed that it would be possible for the peasantry to enact a *communist revolution*. I repeat: Marx was open to the idea of feudalism revolting directly towards communism (p. 18).

This is not the Marx acknowledged by most orthodox historical materialists. The impression that Marx believed in historical determinism is even acknowledged in Gramsci's writing. I cite, once again, *The Revolution Against Capital*, where Gramsci "notes" how the success of the Bolshevik Revolution directly contradicts the predictions of Marx[6]. Gramsci states that the "canons of historical materialism are not so rigid as one might have thought and has believed," implying, at the very least, that contemporary Marxist thought would not have been able to account for such a social development. Such a statement foreshadows Gramsci's divergence from his "Marx" on the matter of historical determinism at large.

Gramsci. Although Gramsci does not embrace the social atomism seen in classical liberal ideology, he does diverge significantly from the historical determinism present in Marx's

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[5] In Marxist-Leninist literature, this is general referred to as "two-stage theory"—the idea that a feudal country must pass through a stage of capitalism before sustaining socialism (Strada, 2010; *Glossary of Terms: St*, n.d.).

[6] Whether or not this is an accurate interpretation of Marx is irrelevant.

writings. Gramsci identifies the will as the ultimately determining factor for historical

development in *The Revolution Against Capital:*

> …the dominant factor in history [is] not raw economic facts, but man, men in societies,
>
> men in relation to one another, reaching agreements with one another, developing
>
> through these contacts (civilization) a collective, social will; men coming to understand
>
> economic facts, judging them and adapting them to their will until this becomes the
>
> driving force of the economy and moulds objective reality, which lives and moves and
>
> comes to resemble a current of volcanic lava that can be channeled wherever and in
>
> whatever way the will determines. (Gramsci, 2000b, p. 33)

The quote above clearly elucidates Gramsci's beliefs regarding historical determinism.

There are several principles that can be gleaned from this quote alone. The fact that interpretation

is important in determining the actions of humans implies that a given set of material conditions

does not necessarily imply a specific action. Ultimately, Gramsci believes that subjectivity is a

factor when guiding human behavior. Another interesting point is the language used for will

becoming the "driving force of the economy." Traditional Marxist theory tends to frame the

economy as the "driving force of history." If will drives the economy, and the economy drives

history, the this must imply that history is more fundamentally driven by something non-

economic. Another interesting point of divergence from Marx is where Gramsci claims that

history "can be channeled wherever and in whatever way the will determines." Note the word

choice here. Gramsci specifically says "wherever" and "whatever." This is a far cry from the

idea that history must necessarily develop in stages. This appears to imply that communism is no

longer a historical necessity; in fact, if one were to follow this logic to its conclusion, then

capitalism could potentially devolve back into feudalism if humanity does not will a proletarian

revolution.

However, Gramsci remains measured. The earlier quote is in reference to the Bolshevik

Revolution. Gramsci is attempting to defend the validity of a revolution within traditional

Marxist theory. Note that earlier in this passage, Gramsci argues that the older, deterministic

model of Marxism has accuracy "under normal conditions" (p. 34). Gramsci justifies the

proletariat in Russia developing class consciousness according to multiple factors. "Socialist

propaganda" allowed the Russian proletariat to develop class consciousness according to the

theory expounded to more developed nations. In addition to this, "war galvanized the will."

What war is Gramsci referencing specifically? It is likely World War I, traditionally considered

to have started because of nationalism and imperialism. These are traditionally considered to be

capitalist phenomena in the Marxist analysis, which means that they would have resulted from

the contradictions inherent in the structure of society.

The source of historical progression within Gramsci's writings is therefore complicated

to the point of near obscurity. A few questions are unanswered: Is it really will directly that

caused the Russian revolution? What caused the will?

The charitable interpretation of Gramsci is that history allows for specific potentialities

instead of directly determining the action of humans. It is true that the Bolshevik Revolution

happened after a period of international and domestic war. It is also true that Gramsci

emphasizes the role of culture for providing a focus for the will to act upon its conditions.

Perhaps the strongest way to reconcile this is to say that the Russian people were oppressed

beyond a critical threshold, but would likely not have spontaneously developed Marxist theory

on its own. This would have been near impossible, since they had not gone through what is

normally a necessary stage of development for philosophy and culture. "This," Gramsci writes, "is what happens under normal conditions. When history develops through stages, which, though ever more complex and richer in significance and value, are nevertheless similar" (p. 34). However, since capitalism had since expanded beyond the national boundaries of Classical Marxist orthodoxy, it allowed for the *potential* of an international proletariat to export the necessary culture to propel Russians toward action. This necessary culture, the Socialist Propaganda, the philosophy of praxis, the Marxism—it allowed for the will to be concentrated in a way that was congruent to the rules of "objective reality." It could be the case that the people in Russia would have stumbled upon a proletarian revolution without Marxism, but such an outcome would have been substantially less likely. It is also true that even with Marxist theory the people of Russia could have not succeeded. Because what is most important is the "interpretation," they could simply have had one that called for inappropriate praxis.

Although Gramsci believes that history is not "rigid," he does acknowledge some forms of necessity. When discussing the character of the state as a regulatory power in an essay called "Americanism and Fordism," Gramsci mentions that it has an "unavoidable economic necessity" to act as a facilitator of "production and exchange" (Gramsci, 1971b, p. 314). Does this imply that people are bound to action according to their structural circumstances? Such a position is untenable, at least when drawing upon this quote. Just because *the state*, an institution with a function, is bound by the rules of necessity, this does not mean that the people themselves necessarily have to act according to a specific economic structure. It simply means that the state would cease to exist otherwise. A comparable example is when a dog is being fed. The dog has an "unavoidable physical necessity" to be fueled by food; this does not mean that people are *required* to feed it. The dog ceases to exist when it is not fed. (This particular example is a metaphor, and a fairly morbid one at that. Regardless, it still illustrates the point sufficiently, even if it is not exactly the same.)

Consolidation of Core Beliefs

Marx.

1. History does not progress according to a unilinear evolutionism.
2. The driving force of history is the development of ideological conditions that emerge interdependently of relevant societies.
3. It is possible to have a communist revolution in a society that has not yet established capitalism.

Gramsci.

1. History does not progress according to a unilinear evolutionism.
2. The will is the driving force of the economy, and, therefore, history.
3. It is possible to have a communist revolution in a society that has not yet established capitalism.

Clearly, these two positions vary drastically in their language and theory. Gramsci and Marx (at least in my reconstruction) obviously hold an irreconcilable difference on the topic of historical necessity. Still, an equally consequential topic requires more elaboration: how do Marx and Gramsci compare on how they conceptualize the "real theater of history"?

Civil Society

The schism between Marx's and Gramsci's conceptions of civil society and the superstructure form some of the most contentious literature surrounding Gramsci's fidelity to Marx. Accusations have ranged from negligible deviance from existing literature to outright abandonment of Marxism. For some, Gramsci is merely rearticulating established theory, and thus does not represent anything more than that (Saccarelli, 2008, p. 9). Yet, others have argued

that Gramsci's views represent a break to idealism that regresses back to Hegel (Bobbio, 1979, p. 33). I do not believe that either view is correct. I will first provide context with Marx's views on the subject. Then, I will reconstruct three arguments seen in Gramsci scholarship, propose that Gramsci's view of civil society does not stand neatly within the orthodoxy of Marxism or liberalism, and then illustrate how it differs from the views of Marx.

Exposition of Core Beliefs

Marx. I contend that Marx thought that the civil society was an inadequate model for explaining social phenomena. Firstly, I will reconstruct Hunt's argument for an evolution of terms within Marx. Secondly, I will defend this interpretation against Cohen's and Bobbio's.

The strongest argument for Marx's abandonment of civil society as an accurate description of social life was articulated by Gregory Hunt in *History of Political Thought* (1987). He argues for an evolution in Marx's thought that can be divided into three phrases: Hegelian, transitional, and "mature." Hunt pushes that the civil society actually has *two* meanings in Marx's later writings, which Hunt describes as the "phenomenal content" and the "ideological form" (p. 274). In the former, he describes it as the "totality of the relations of commodity exchange and circulation in the capitalist social formation." The latter is the "conception of society as an aggregate of free, equal, self-interested, property-owning individuals bearing rights." The former is what Marx uses in his economic analyses, and the latter is a bourgeois conception of society that believes in social atomism. For Hunt, civil society is "both [structure] and superstructure."

To be clear, Hunt is actually referring to two different things under the same name. One is an accurate description of structural forces from a critique of idealist social relations; the second is the *liberal abstraction* of those same idealist social relations. Henceforth, I will refer to the former as civil society-as-structure, and the latter as civil society-as-abstraction.

This interpretation of civil society representing economic relations seems to find company with the Gramsci scholar Norberto Bobbio. He argues that Marx considers civil society to be the "development of economic relations which precedes and determines the political moment" (Bobbio, 1979, p. 29). The language closely mirrors that of analytical Marxist G.A. Cohen (2020). In both instances, these respective philosophers consider civil society to be the part of the structure that produces culture and relationships that are not narrowly associated with that of the governing body. Civil society is the non-governmental relationships between people that produces a "collective identity and culture." Again: it *produces* the identity and culture.

These words imply much about the source of the driving factor of history. If the civil society-as-structure produces the identity and culture, then that means that it dictates the conditions themselves, rather than allowing for an independent force to be limited by a set of conditions. One might compare culture to a gear that rotates and pushes a piston: the piston moves according to predetermined conditions; it has a set path of motion.

Gramsci. I contend that Gramsci strongly diverges from this metaphor. When one considers Bobbio's reconstruction of Gramsci, it becomes clear that there are some fundamental differences between Gramsci and Marx.

Firstly, Gramsci, in Bobbio's view, does not consider civil society to be an expression of the structure. Bobbio proclaims outright: "*Civil society in Gramsci does not belong to the structural moment, but to the superstructural one*" (1979, p. 30). He defends this view by reprinting a quote of Gramsci who states that "civil society" and "political society" are "two major superstructural 'levels.'" He also argues that Gramsci's "revaluation of civil society is not

what links him to Marx, as a superficial reader might think, but what distinguishes him" (p. 31). He believes that someone who interprets Gramsci as simply moving Marx's conception of civil society to the superstructure is not engaging critically with the subject. For Bobbio, such a philosopher would be missing a crucial aspect of Gramsci's conception of civil society: he "derives his own concept of civil society not from Marx, *but openly from Hegel* [emphasis added]". What does this mean, and what are the implications of this determination?

Bobbio's Gramsci holds a broader definition of civil society. In Bobbio's interpretation, "civil society includes not only the sphere of economic relations, but also their spontaneous or voluntary forms of organisation" (p. 32). He directly quotes Gramsci as defining civil society "as the political and cultural hegemony of a social group on the whole of society, as the ethical content of the State" (p. 31). Given what I have already analyzed earlier, with specific emphasis that Gramsci believes that it is not merely "economic facts" that govern behavior, but "interpretations" of those facts, such a conclusion makes perfect sense. The "spontaneity" and "voluntarist" behavior that Gramsci holds to be central to his definition of civil society fits in with the anti-teleological bent that Gramsci has adopted throughout his oeuvre. How could history possibly be determined by the necessity expounded by the same Marx that wrote *Capital?* If history were determinate, these actions would cease to be "spontaneous" insofar as one defines the word in terms of an unbounded metaphysical disconnect between cause and effect. Gramsci asserts the importance of the relationship between the superstructure and the structure, but *not* the historical necessity and unicausality characteristic of an Orthodox Marxist. In Gramsci's view, the material conditions are a *factor*, but not *the determination* of people's behavior.

The contrasting model that fits Gramsci's vision would be a pachinko machine with several balls at the top. As they fall, the interactions between them are indeterminate to the observer. For all intents and purposes, they move freely, bouncing among the pegs in the machine. However, their paths are limited by the conditions and possible results that the machine offers; they cannot somehow leave the machine; they must reach the bottom. But their motion is not propelled by something along a set path in the same way that the gear directs the piston. There is significantly more latitude in their actions, and the balls may not all land in the same place. In the initial model discussed in Marx's conception, the motion of the path is set and determined by the initial motivating factor (the gear). In the pachinko model, the motion of the path is indeterminate, even if the results are limited by the physical characteristics of the machine and "structured" in a loose sense of the word.

Consolidation of Core Beliefs

Marx.	Gramsci.
1. The "theater of history" is in civil society.	1. The "theater of history" is in civil society.
2. Civil society must be thought of in two ways: the ideology of idealists, and as a sarcastic description of real relationships.	2. Civil society
a. Civil society-as-structure presents relations merely as an abstraction of real value extraction, in terms of "economic relationships" that exist in the structure.	a. represents a real phenomenon of "economic" and "social relationships" that exist in the superstructure.

b. Civil society-as-abstraction is a liberal view that adopts an incorrect ontology of social atomism that exists in the superstructure.

3. "Economic relationships"

a. are defined scientifically as the position that one has regarding value distribution after the production of a commodity

b. exist in the structure of society

c. alone produce the culture

4. "Social relationships"

a. are ontologically separate from economic relationships and exist in the superstructure.

b. do not produce culture as an independent force from economic relationships.

Further Remarks of Core Beliefs

So, it has been established that Gramsci holds a different view about civil society that incorporates it into the superstructure. Furthermore, the description of civil society is taken from

b. is defined in the Hegelian view in which it "includes not only the sphere of economic relations, but also their spontaneous or voluntary forms of organisation."

3. "Economic relationships"

a. are defined scientifically as the position that one has regarding the value distribution after the production of a commodity

b. exist in the superstructure of society

c. do not produce culture alone

4. "Social relationships"

a. are not ontologically separate from economic relationships and exist in the superstructure.

b. produce culture as an independent force from economic relationships.

Hegel, and is defined not in terms of relationships of commodity exchange (an economic category) but also in terms of the relationships between people (a social category). Keep in mind that this is a false equivocation of terms if we are to take Gramsci's understanding of Marx: for Marx, civil society is only an expression of relationships insofar as the language describes an underlying quantitative structure. In the equation $2 + 3 = 5$, the antecedent numbers, 2 and 3, have a *quantitative* relationship with the consequent, 5. This is the same type of relationship between capitalists and proletarians insofar as there are equations expressing quantitative values that correspond to social phenomena. The relationships are defined in terms of their exploitation. These are not simply the *social relationships* that people have. It is not a relationship insofar as the capitalist has casual conversation with the proletarian and go out to bars after work. It is the explication of a "scientific" principle.

It makes sense that Gramsci would think this way, if he truly holds the will to be as important in determining history. The culture is not arbitrary, as it would be in a liberal ideology, but it is also not directly determined according to stagist Marxist-Leninist theory (Stalin, 1977). Therefore, Gramsci diverges from both liberalism and Marxism in his analysis of civil society, a view affirmed by Hunt (1987).

Conclusion and Further Research

Although we have demystified much about the relationship between Gramsci and Marx, we are left with additional questions that require dedicated attention. Certainly, further research is necessary to preserve nuance between their views. Marx clearly argues that uneven development can produce revolution in areas that are not directly materially developed. Gramsci argues that the will can mold history however it pleases; yet, it is not arbitrary. What does this mean in terms of substantive differences between the malleability of historical progression? If

Gramsci frames his civil society in Hegelian terms, what are the implications of that on the field

of international relations? Clearly, these issues can and must be researched further.

It is clear that, given the evidence, Gramsci represents a moderate divergence from

Marx's views. Since I established that the criteria of "moderate divergence" is fulfilled when

there is any *non-identical* core belief between Gramsci and Marx, the thesis was satisfied in the

first section for epistemology and realism. Since a conclusion would be unsatisfactory to the

majority of readers, I have demonstrated that there are *multiple* significant differences across a

broad range of consequential fields of philosophy.

Still, some may find these criteria dissatisfying for deeming Gramsci a "moderately

divergent" philosopher from Marx's writings. Why not emphasize the role of praxis in the

construction of history, and claim that any other difference is merely superficial? I imagine that

there are an indefinite number of ways to establish criteria for a "moderate divergence," which is

why I decided to limit myself to the most analytical method. I do not value a core belief over

another. I do not factor a subjective judgment system into the satisfaction of the thesis. If there is

even *one* difference between their core beliefs, then that is satisfactory.

Yet, if one desires additional commentary beyond the thesis, then the claim to internalize

is that Gramsci is not a total change or stagnation of Marxist philosophy. There may be some

consequential differences surrounding metaphysics. There are certainly strong contrasts between

the language of necessity seen in the majority of Marx's mature works and Gramsci's. But there

are also multiple areas of common ground to be found regarding the late Marx and Gramsci on

Russian revolution and law of value. We are left to conclude that there are two misconceptions

one can have on the topic; both the interpretation of Gramsci as a radical idealist or as a

milquetoast pseudo-revisionist are inaccurate and should be discarded. The divergence is

moderate.

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Rachel Hester   **Sustainable Consumption**

Sustainable Consumption

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Abstract

Our team noticed that trash is everywhere in our everyday lives, and we hear on the news about landfills taking more and more of our space on earth. In order to assess possible solutions to this growing issue, we surveyed Cal Poly Pomona students' ability to determine which types of material they should recycle, compost, or trash.

Introduction

A large part of ethical consumption is proper waste management, since the waste left behind can harm the environment. Not only is it important to dispose of trash, it is even more important to correctly sort it, since still-usable waste takes up unnecessary amounts of space in landfills, and the wrong types of waste going to methods of recycling will disrupt those processes. For the Cal Poly Pomona community, recycling and composting aren't as readily available as they should be, which results in the majority of waste that could be reused ending up in the garbage. Additionally, there is a lack of educational resources for people to learn what is acceptable for each kind of waste disposal method.

Methodology

We conducted a survey asking specific questions concerning sustainability. Our target audience was the student body of Cal Poly Pomona and our survey was sent to our classmates. Thus, the data we collected reflects the knowledge and opinions of freshman STEM majors.

Results

Personal Sustainability:

Students' Proper Disposal of Specific Materials:

- Paper Milk Carton (Recycle): 81.3%
- Plastic Utensils (Trash): 28.1%
- Paper Towels (Compost): 18.8%
- Orange Peels (Trash): 12.5%
- Aerosol Can (Recycle): 56.3%

Compost:

- 87.5% of students put food in the trash because there were no composts bins
- 81.5% of students wish to add more compost for the campus

Conclusion

Based on the data, college students, despite caring about the environment, often aren't sure what types of waste they should recycle, compost, or trash. This implies that if given the opportunity and knowledge, it's possible that college students could and would recycle and compost more often. Therefore, there should be some way to educate the general population on wastes and how to manage them. After that, we can take more steps such as making readily available recycling and composting stations to utilize the newly knowledgeable public.

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Ramirez Kathleen   **Senate Bill 8: An Intersectional Analysis of Reproductive Justice Consequences of the Texas Abortion Ban**

Abstract

In 2021, a law known as Senate bill 8 (SB8) criminalized the act of abortion in Texas. Unlike previous abortion bans, SB 8 permits any person who is not an employee of the state to file a lawsuit against those who receive an abortion and those directly or indirectly aide in the process. In this research, I analyze the impact of reproductive rights policies affecting intersectional populations of women of color, low-income and working-class people, trans people, and people who are immigrants. Through theoretical frameworks such as Critical Race Theory (CRT), I study reproductive rights policies such as SB 8's harmful, disproportionate impacts upon historically marginalized people. The feminist standpoint theory is deployed toward recognizing the power structures that enforce these ideas. Previously, CRT and intersectional feminist theory have been used to examine laws like SB 8, such as the fugitive slave act used to enforce Jim Crow laws, and the criminalization of abortion before Roe v. Wade (suggest adding citation for this). My research methodology centers on literature review as an examination of previous research to identify patterns, and empirical findings regarding policies on abortion and medical statistics. This paper aims to broaden the lens through which people view the complexities of reproductive policies.

Background

Reproductive rights have been at the center of political discourse long before the landmark case known as Roe v. Wade (410 U.S. 113, 1973), which granted women constitutional protection of liberty to choose to have an abortion without excessive government interference. Scholars argued this was a new level of achievement for all women in the United States because it granted their privacy and natural rights. However, this new form of liberty did not last long as many politicians have found ways to implement bans on abortion without violating Roe v. Wade. In 2021, Texas Governor Gregg Abbott passed Senate Bill 8, which bypasses Roe v. Wade by relying on private citizens to pursue legal action against abortion. In the United States, no other ban on abortion has utilized such extreme forms of vigilantism and limitations on reproductive liberties. Unlike any other abortion ban, SB8 prohibits abortions after the 6th week of pregnancy. However, many people are not aware they are pregnant until after their 6th week term. The exceptions are narrow and limited to circumstantial health SB8 indicates that those involved in the process of aiding in an abortion face a $10,000 fine, if successful. Political discussion surrounding abortion is usually through of pro-choice or pro-life dichotomies; consequentially, leaving out the voices of people who are most impacted by restrictive reproductive laws. When policies pose strict limitations and consequences, there are disproportionate effects for historically marginalized groups that are often under-represented at a legislative level. I argue that to understand the full scope of the social injustices created by reproductive laws, the social, economic, and health disparities compounding racial and gender inequities must be analyzed and addressed in the formation of such policies.

Review of Literature

In this research, I investigate the intersectional consequences of SB8 on predominantly minority groups by analyzing scholarly and popular articles and data regarding the effects of reproductive rights injustices. I draw on literature and data across demographics to examine the interrelated nature of abortion policies and social injustices. Throughout my research, I have found statistics pertaining to BIPOC, Latinx, and LGBTQIA+ people are minimal due to the lack of representation these groups have received in relation to abortion. Gathering and synthesizing the information that is available has served as the building blocks of my research. While recent research showing the impact of SB8 has supported my research, studies performed during the passage of Roe v. Wade have also been helpful.

Key terms

Critical Race Theory (CRT), according to the legal scholar Richard Delgado (2017), is an integral approach to, and an academic study of the institutionalized hierarchy between race, racism, and power. Critical Race Theories draw from ideas of pioneer figures in American culture such as Sojourner Truth, Frederick Douglas, Cesar Chavez, Martin Luther King Jr., and the Chicano and Black power movements (Delgado, 2017). Delgado suggests CRT questions the foundations and principles of constitutional laws regarding inequities through social, economic, and political reforms. The first CRT feature Delgado presents is that stark racial disparities continue to exist in our society despite civil rights reforms due to the structure and enforcement of racist legislations or policies. Delgado emphasizes that systemic racism is difficult to address because it is not acknowledged (2017). Another feature of CRT presented by Delgado, is the social construction of race, which is the idea that race is a product of social thought rather than biological evidence, yet the color of a person's skin has historically been indicative of rights they receive. The important contributions of Delgado's work are essential in this research because CRT highlights unique perspectives of Black, Latino, Muslim, Asian, LGBTQIA+ (etc.) people and how institutionalized racism in the legal system can still disproportionately affect them.

The writer and social activist bell hooks (2014) examines the cultural, class, political, and legal oppression of women through a feminist theoretical approach. hooks presents feminist theory as a movement to end sexist oppression by working towards the eradication of domination in all human relationships (hooks, 2014). hooks argues that an intersectional race-sex-class perspective is necessary to understand the inequities in a white dominated society that maintains a status quo. Written nearly 40 years ago, hooks addresses pressing issues that are still prevalent today such as healthcare, reproductive rights, and poverty. Black feminist theory contributes an analytical lens to the process by which a person's body is politicized and stripped from autonomy by involving hypotheses and explanations based on knowledge and experience (hooks, 2014). Feminism, according to hooks, calls attention to the diversity of people in a social and political realm by centralizing experiences of people who have been historically marginalized (hooks, 2014). The frameworks of feminism in politics is pertinent to the understanding of female-identified bodies in relation to personal freedoms in a society where reproductive rights are controlled. hooks discusses that in order to end oppression on political, social, racial, and biological levels we must turn our attention to the "systems of domination and the interrelatedness of sex, race, and class oppression" (hooks, p.33, 2014).

Political scientist Anne Phillips (1998) deploys feminist theory to answers questions about gender, sex, and sexuality in politics. The author discusses power structures of political theory and practice through feminist framework to provoke political change. Across twenty articles covering a variety of topics such as equality, anti-discrimination, identity, representation, Phillips addresses the political polarization of women's rights to their bodily autonomy. Phillips presents feminist theory in politics to create room for explicitly ethical politics to question the way politics have been conceived and practiced (Phillips, 1998). The author uses representations of masculinity and femininity to depict the regulation of sexuality as a mechanism of control to maintain sexual inequity (Philips, 1998). I argue that feminist theoretical frameworks such as those of hooks and Phillips provide essential perspectives to the complexities and interconnectedness of gender, sex, childbearing, and the oppression of women as seen through politics.

Vulnerable Populations and Research Importance

Physicians and health care policy experts, David Blumenthal and Laurie Zephyrin (2021), explore SB8's direct impact on women of color through imposed reproductive restrictions. The authors examine how the SB8 policy exacerbates racial disparities and inequities in maternal health in Texas. Blumenthal and Zephyrin gather statistics of the State's health care system to examine the mortality rates of black and white mothers and infants. The authors discuss the repercussions and implications of SB8 will inflict on Black women seeking access to reproductive health care. Furthermore, they discuss some of the reality's women of color experience due to a lack of available health care. Blumenthal and Zephyrin incorporate CRT to explain how SB8 will continue to exacerbate systemic racism (Blumenthal & Zephyrin, 2021). This important research contribution identifies how policies and institutionalized structures can directly produce inequities that hurt people of color.

Public policy and health expert, Laurie Jefferson (1989), studies various social, cultural, and economic factors negatively affected by reproductive laws. The author contributes an intersectional approach as an essential work needed to discuss the implications of reproductive health policies. An intersectional framework emphasizes that discrimination and oppression are constituent to a person's race, gender, ethnicity, cultural background, and more (Jefferson, 1989). This reading provides a contrast of analytical works from over 30 years ago regarding the same reproductive issues discussed in this research. The author discusses the lack of information regarding women of color and low-income and working-class women, though these women will suffer disproportionately from politicized reproductive policies. Jefferson acknowledges the failure to take into consideration social and cultural differences when addressing reproductive health issues, while examining how political structures impose limitations on a variety of issues concerning accessibility to healthcare (Jefferson, 1989). Jefferson's stance on women's reproductive health is useful as many of the problems she addresses are relevant today.

Journalist Candice Norwood (2021) provides a brief overview of the imminent implication SB8 will pose on civilians and how it will perpetuate larger patterns of racism daily. Through discussions with scholars, the author analyzes how the law impacts residents of Texas and the foreseeable future for women of color. This article contributes reflections of historical systemic racism in relation to the Texas abortion ban by identifying similarities and differences in previous racist policies. The author presents research of those who have been directly impacted by SB8 and determines SB8 will work as a catalyst to further marginalize already vulnerable groups.

Indirect and Direct Impacts

Health communications professors, Leandra Hernandez and Sarah Upton (2020), discuss the recent gendered, sexual, and reproductive violence occurring at the Mexican U.S. border, specifically in the junction of El Paso and Cuidad Juarez. The authors discuss negative impacts on reproductive justice resultant from the political and social stigmatization of the migrants at the Mexican- U.S. border. The authors present an important intersectional and Latina feminist standpoint regarding the vulnerabilities and experience of migrant women including transwomen. This perspective is critical to analyzing SB8's harmful impacts on Latina populations of the Southwest in general and Texas in particular. Chicana feminist scholars interrogate the ways in which reproductive injustices can affect Latinx American and Latin women in devastating ways (Hernández & Upton, 2020). The article contributes crucial information through Chicana feminist theoretical frameworks toward understanding the relationship between women of color, transwomen, reproductive policies, poor health conditions, and a fetus (Hernández & Upton, 2020).

Former Director of Government affairs at the Guttmacher Institute, Susan Cohen (2020), studies common themes across contraception, abortion, and unintended pregnancies in minority communities. The author examines the disproportionality of abortion rates communities (Cohen, 2020). The author discusses the geographical and financial restrictions that affect availability and access to contraceptives. Cohen provides statistical visualizations of the disproportionate rate of unintended pregnancies, abortion, contraception, and healthcare resources in lower-socio economic or diverse communities. According to Cohen (2020), 34% of white women receive abortions whereas 67% of abortion are obtained by women of color.

Methodology

In this research, I participated in a collaborative research group with students from the University of Houston and my mentor, Dr. Stovall. Throughout a period of five months, I conducted anthropological participant-observation research as I periodically met with the Houston students via Zoom to discuss social justice issues in Texas and the effects they have on marginalized groups. Professors of Religious studies, Steven Engler and Michael Stausberg (2011), describe participant research as the process in which a researcher immerses themselves into the culture and gathers first-hand experience, rather than relying on second-hand reports. The participant-observation ethnographic research method contributed a personal level of understanding of my peers in Texas, and those experiencing unfair treatment at the hands of the Texas politicians. Enhancing my participant-observation

spectrum, midway through my research project, I was able to travel to Houston with Dr. Stovall to collaborate face to face with the University of Houston students. The students shared their first-hand experiences of what it is like to live in Texas and witness the developments of certain political injustices that deprive people of their natural rights. Moreover, students shared how they and their families have been personally affected by specific events that draw political attention.

We discussed what these issues mean for immigrants, people of color, and how they perpetuate disproportionate inequity. Furthermore, I regularly met with Dr. Stovall privately to discuss the historical context of racial inequities brought by restrictive legislations such as Jim Crowe, Fugitive Slave act, Voting ID laws, immigration, reproductive laws, and more. Dr. Stovall helped me conduct historical and scholarly research on the inexplicit violence that racist legislation condones, to the silent social and economic injustices that continue to flourish in political and legal systems by providing me with a variety of resources by notable authors with significant importance in the realm of social injustices, in addition to reading Dr. Stovall's book, Liquor Store Theatre (Stovall, 2020).

Theory deconstruction was another essential method used throughout my research. To constructively organize my findings and hypothesis, I used theoretical frameworks such as Critical Race Theory, Chicana feminist theory, and Black feminist theory. I applied my knowledge about the theories to objectively interpret the power imbalances found in gender politics and racial disparities that are exacerbated by policies such as SB8. I gathered a variety of resources that discuss feminist theory and critical race theory from multiple perspectives including a political and social views. Furthermore, the contrasting times in which the books were written provide historical relevance to present issues surrounding abortion. During my class and research meetings with Dr. Stovall, she discussed the importance of these theories while connecting them to real world applications such as the anthropological monograph Liquor Store Theatre (Stovall 2020). By creating a meaningful and memorable experience, I gained a better understanding of the pertinence in using CRT and feminist theory in circumstances where personal freedoms are being compromised by political systems.

Throughout my research, I used an autoethnographic approach to understand the cultural experience had by those most impacted. I reflected on my own experiences as a heterosexual Latina woman living in a patriarchal capitalistic society that has benefited from the extortion of marginalized groups. Witnessing the legal hardships my family has endured due to their immigration and socioeconomic status, I have become more aware of the similar experiences of families with backgrounds similar to mine. From my perspective, it seems obvious that the hierarchal position of Latinos is at a disadvantage from our white counterparts because of our backgrounds as immigrants or being less financially fortunate and the reality of the social and legal construction of race and intersectional hierarchies.

However, these disadvantages are seldom discussed with the necessary attention to bring change. I did not grow up with access to many resources that others may come by easily because either 1) we did not have the money or, 2) the resources were not systemically made apparent for immigrants to know where to find them or how to access them. In my culture, it is usual for females to take the position of silence with the man

having the ultimate say in what goes. Before my parents divorced, this is what I knew to be normal. Women oversaw handling domestic and family duties while men made the big decisions for the family–both had jobs to support the family. Unfortunately, this same idea applies to women like me in the world at large. We are expected to take the position of silence and follow orders given to us by a man because we are female. The expectations of a man and a female differ significantly in my culture, which reflects how women are perceived in society and how the rights, responsibilities, and roles of women are produced through reproductive legislation as my study demonstrates.

Findings and Analysis

Healthcare

In order to fully grasp the amount of damage SB8 will cause to women of color of childbearing age and their offspring, it is important to understand how the healthcare system of Texas has failed them for years prior. Before Texas passed SB8, Black infants were twice as likely to die than white babies before their first birthday (Blumenthal & Zephryn, 2021). Notably, Texas does not report their deaths among new mothers by race. In 2019, the national Black maternal mortality rate was 44 deaths per 100,000 live births compared to 17.9 per white deaths. Therefore, there is multiple reasons to expect this pattern to persist in the state of Texas (Blumenthal & Zephryn, 2021).

Another indicator of inequity found in the Texas health care system is Medicaid eligibility. Texas has not expanded the eligibility of certain procedures and resourced under Medicaid that are commonly sought for preventative health care and well-being, primarily by people in lower socio-economic groups. In 2018, Black people are twice as likely to die than white people from preventable conditions due to a lack of access to necessary healthcare (Blumenthal & Zephryn, 2021). Evidently, SB8 will exacerbate existing inequities found in the health care system of Texas by further predisposing low-income people to delays in basic health care that affect health outcomes. This includes general healthcare coverage and access to reproductive healthcare such as abortions.

Most abortions and unintended pregnancies in the United States are obtained by minority women. In Texas, Black Americans and Latin people make up most of the population. However, Latin people in Texas are erroneously classified as white making the population and abortion census data misleading when interpreted by race. Given that the majority of Latin people in Texas experience social, legal, and political life as underrepresented minorities and do not actually benefit from the white classification, this is a misleading statistical categorization. Research by Cohen (2020) indicates that the abortion rate for people of color is disproportionately higher than white women–all women of color. These numbers reflect some of the difficulties some women or families may encounter in accessing high-quality contraceptive services including instructions of certain birth control methods. Unplanned pregnancies are associated with higher rates of maternal mortality, prematurity, and infant mortality. SB8 will therefore compound the long-term damage of racism in the Texas health care system, disproportionately injuring Black mothers and their children (Blumenthal & Zephryn, 2021).

Economic

Some of the primary issues for low-income groups and women of color groups is access to financial resources. Currently, there are only six planned parenthood clinics out of thirty-six that provide abortion procedures in Texas. Other facilities have been forced to close due to the burdensome and strict regulations placed on abortion facilities. As a result, those in need of an abortion are forced to travel out of state to an abortion clinic that does not require a wait-time or mandated counseling. The consequences are the displacement of low-income people and immigrants as patients, furthering the economic inequity in their communities. After the passing of SB8, out-of-state clinics surrounding Texas are continuously over-whelmed with the demand of request for abortion appointments from Texans. Consequentially, many are unable to reserve an appointment. Beyond unavailable appointments–driving time, gas costs, lodging, and time off work, are other factors that may be obstacles for some. According to Neelam Bohra and Jolie McCullough (2021), those who could afford the out-of-state trip were primarily higher income, white folks. While Hispanic/Latinx people and immigrants had higher abortion rates in 2020 than any other racial group or ethnic group, they are not able to leave the state. Many immigrants from Central and South America are unable to leave state or city borders due to immigration checkpoints. For others, the cost of health care alone can be a burden (Bohra & McCullough, 2021).

Reproductive limitations have disproportionately affected lower income woman and women of color. The broader economic factors that impose limitations on reproductive choice, such as when and under what conditions, are not adequately represented. Often, women of color and poor women do not have the same availability of options as other women. They may encounter various economic struggles when experiencing an unintended pregnancy, and wanting an abortion as a result. Families, or impregnated people, must often consider their current financial situation before considering bringing a child into the world. Many low-income families and individuals in Texas fall under the poverty line, thus, they already struggle to fund their own basic needs such as food, water, insurance, housing, heating, electricity, etc. Moreover, many insurance plans, including Medicaid, have changed their policies pertaining to abortions in Texas after the passing SB8. Many Private insurance companies have altered their policies to only cover abortion in cases of life endangerment or if the health of the person impregnated is severely compromised. Notably, under SB8, obtaining an early abortion would be impossible as it bans an abortion after six weeks. The differing living circumstances for them make it difficult to obtain early abortions. In the circumstance of a late abortion, money is usually the cause for delay. Abortion does not always fall under Medicaid coverage, which has caused many women to delay having abortions while they raise necessary funds (Jefferson, 1989)

Political

Government and politics play an integral role in the structuring of gender, sex, and racial hierarchies. Reproductive policies, such as SB8, primarily affect women, women of color, low-income people, immigrants, and trans-people. To understand the legal oppression of marginalized groups, it helps to study politics from a race-sex-class perspective (hooks, 2014). In a political hierarchy, affluent white men maintain the most congressional seats involved in legal-decision processes. In fact, Texas has only three females of the 38

members of the state's congressional delegation, and women hold just 37 of the 181 seats in the House and Senate, according to David Yaffe-Bellany (2018). The rest consists of white men. The Texas government does not represent an accurate Texas population of less than 40% white-people and over 50% people of color including Black Americans, Latinx/Hispanic people, and Asians. In a non-diverse government, the potential to exclude important perspectives and experiences significantly increases, thus harming minority groups.

SB8 politically displaced gender and sexual minorities (LGBTQIA+) by indirectly barring them from being involved in the process. Women were largely unacknowledged in official texts, uninvited in their formulation, and largely uninvolved in their interpretation (Phillips, 1998). There is a privilege in politics that comes with being a white-heteronormative affluent man, and not a person of color from a lower socio-economic group. A one-size fits all policy overlooks and perpetuates legal oppression through race-gender-class hierarchies (Garcia, 1997). Just as it would be unfair for me to speak on the experiences and disadvantages of a transwoman as a binary female myself, it is unfair for white male dominated government to create policies that only offer a one-size-fits all method concerning abortions.

Social

SB8 will perpetuate larger patterns of racism and discrimination for minority groups by relegating vigilante methods to ensure enforcement of the law. In order to avoid violating the terms of government in Roe V. Wade, Texas has empowered their private citizens to report and sue anyone suspected of aiding, providing, and abetting an abortion. Vigilante action in the form of surveillance and policing has profoundly endangered people of color, and people who have been historically otherized in society such as immigrants or trans-people. Since people of color constitute for most abortions and have less resources to travel outside of the state for a legal abortion, they face a disproportionate amount of punishment. Policies in the past similar to SB8, have created similar social ramifications for minorities. The Fugitive Slave act of 1850 allowed local governments to deputize private citizens to assist in the capturing of run-away slaves who were routinely beaten or murdered for alleged crimes (Norwood, 2021). Endangering forms of targeted surveillance persist to this day, as research indicates that Black and Latin families are more likely to be reported and investigated. Notably, white people are more likely to report Black or Latin people (Norwood, 2021). This pattern further marginalizes trans and non-binary people since they can become pregnant and have been considered groups that experience higher rates of violence, harassment, and discrimination. SB8 allows space for harassment and discrimination by insinuating fear among pregnant people and their families, by allowing neighbors, friends, and anyone who wishes to threaten them of breaking the law.

Conclusion

Policies that infringe on reproductive rights compound the negative affects primarily experienced by women-of-color, low-income people, people who are immigrants, and LGBTQIA+. However, it is possible that Texan politicians failed to recognize the intersectional consequences created by SB8. They way SB8 was designed to only protect

an unborn child and not impregnated people, endangers people who have historically been under-represented by further marginalizing them. Unfortunately, information regarding abortion mainly pertains to white women, or are clustered together into two racial groups– Black or white. As a result of this dichotomization, all other ethnic or racial groups are left out of the discussion. Information regarding the experiences of a Latinx, Native American, Asian/Pacific Islander, and the LGBTQIA+ is inadequate and reveals an urgent need for representative research. As of now, only Roe v. Wade stands to protect them, however, now the landmark legislation is threatened by SB8. Bottom line is, banned or not, people will always find ways to receive abortions if necessary as previously seen throughout history, regardless of the health risk presented. Promoting access to reproductive health care has the potential to create profound differences in people's lives. Reproductive rights need to be discussed from a larger context surrounding broader issues such as the health, economic, social, and political inequities in disproportionately minority groups. Advocating for equity requires creating solutions to complex problems within structures of society. Properly acknowledging and addressing historical, legal, and social inequity can be the first step.

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Ramirez Bryan*

Investigating the growth of different Tritrichomonas foetus strains at different pHs

Abstract

Tritrichomonas foetus is a unicellular flagellated protozoan parasite known to cause trichomoniasis in cattle. Trichomoniasis is a sexually transmitted disease known to affect the reproductive tract of cattle, resulting in abortion and reduced fertility. However, how the immune system combats trichomoniasis is under-characterized. In order to examine T. foetus and the immune response against it, we must first be able to cultivate it. T. foetus is most commonly grown in Diamonds media, however the optimal pH that each different strain grows in is unknown. In a literature search, we found that researchers typically grew T. foetus in a pH of 7.2. Trichomonas vaginalis, a similar parasite known to cause trichomoniasis in humans, is grown at a pH of 6.2. Meanwhile, no modification to the Diamonds media will result in a pH of 6.8. Therefore, we hypothesize that modification of Diamonds growth media to a pH of 7.2 will result in a greater cell count and viability, in comparison to pH 6.2 and 6.8. To determine the optimal growth conditions for T. foetus, we grew four different strains of T. foetus in Diamonds media at pHs of 6.2, 6.8 and 7.2, and compared the growth of these parasites over 5 consecutive days. The concentration of T. foetus was determined via microscope using the hemocytometer and by flow cytometry. Data for the strains KV-1, BP-4, and UT-1 indicate a preference for more basic media, pH 6.8 and 7.2. Overall, these results determined the optimal pH modification to grow viable T. foetus cultures, which will help expand future T. foetus research, particularly studies that seek to characterize different virulence properties of the different strains.

Background research and summary of literature review

Tritrichomonas foetus is a unicellular flagellated protozoan parasite known to cause trichomoniasis in cattle [1]. Trichomoniasis is a sexually transmitted disease (STD), affecting both the male and female population of cattle in different manners. Symptoms vary from case to case and include vaginitis, cervicitis, infertility, abortion, pyometra, and endometritis [2,3]. Bovine trichomoniasis has been found worldwide and has had its fair share of outbreaks in various countries including China, Spain, France, and Costa Rica [2]. In the United States bovine trichomoniasis is endemic, and infection is not routinely reported. Its non-reportable status is due to lack of resources and knowledge surrounding its implications towards the public [3,4,10]. A survey was assessed in all 50 states in regards to the number of T. foetus cases within a 5 year time frame (2015-2019). The survey showed that out of the 50 states, 25 states had at least one positive case, 20 states had zero cases, and data was not obtainable from the 5 remaining states [5]. Surveys of beef herds in both California and Florida, displayed that herd prevalence (at least one in the herd infected) for Trichomoniasis was 15.8% and 30.4% respectively. [6,8]. Alongside a prolonged breeding season, a prediction model displayed that bovine trichomoniasis can reduce annual calf crop production by roughly 14%-50% [7].

There is currently only one licensed vaccine for bovine Trichomoniasis, known as TrichGuard, which reduces shedding of the parasite [12]. The vaccine is comprised of whole-killed parasites (T.f) and has been shown to increase both the conception and pregnancy rate in herds [11]. Other studies that used whole-cell vaccines showed that they were efficient in reducing the duration of the infection, prompting a greater immune response, and reducing pregnancy loss within herds. However, there is no evidence to support that the vaccine/s work in preventing spread or reducing the amount of infection [13-16]. An effective method of controlling bovine trichomoniasis is through artificial insemination, rarely is the parasite transmitted through artificial insemination [9,22,27]. The only preventative measures that can be taken is testing and the culling of positive-tested cattle [9].

In regards to the killing/death of Tritrichomonas foetus, the immunological mechanism and pathways are still unknown. Trichomonas vaginalis, similar to T. foetus, is also a unicellular flagellated protozoan parasite that causes trichomoniasis. T. vaginalis causes trichomoniasis in humans, the parasite is killed by neutrophils via trogocytosis meaning "to nibble" [17]. Therefore, we hypothesize that bovine neutrophils kill T. foetus using trogocytosis.

As a first step toward examining how bovine immune cells kill Tritrichomonas foetus, we first need to cultivate it in the lab. T. foetus is most commonly grown in Diamonds media; however, it is unknown how specific modifications to the pH of the media will affect the growth of different T. foetus strains in our laboratory. Although other types of media are available, it was shown that Diamond's media in comparison to other types of media resulted in the largest mean parasite concentration [18]. Most of these observations were made over a course of 7 days, displaying that the maximum growth count is observed in days 2 through 4 [18-21]. Research observing the different temperatures for both the transport and culturing of T. foetus displays that the temperature for incubation ranges from 30-37°C [19,20]. The ideal pH for the Diamonds media used in these various research projects range from 7.2-7.4, with some variance between some ingredients [21]. Different preferences in pH's have been observed when comparing feline T. foetus isolates and bovine T. foetus, with the feline isolate having more tolerance to acidic conditions. The bovine isolates could not seem to tolerate the acidic condition (pH 6) resulting in less live and healthy cells [25].

Rationale/Analysis of Literature

We hypothesize that modifying the Diamonds growth media to a pH of 7.2 will result in a greater cell count and viability, in comparison to other pH modifications. In order to determine how modification of the pH of Diamonds media, will affect the growth of different Tritrichomonas foetus strains, we will cultivate, count, and compare the growth of the strains in the different pH's. In past studies, there were minimal modifications in regards to ingredients. However, the modification/adjustment of pH was always completed at the end to ensure that the media falls within the 7.2-7.4 range [23,26]. This pH can be explained through findings that suggested that the optimal pH range for T. foetus adherence to vaginal epithelial cells ranged from 6.0-7.5 [24]. Past studies about T. vaginalis use Diamonds media to grow cultures, however the media is modified to a pH of 6.2 [17]. Since T. foetus

and T. vaginalis have similar morphologies, both cause of trichomoniasis, and both grow in Diamonds media, it is possible that the same pH modification done for T. vaginalis' media might work for the growth of T. foetus as well. Following the recipe for diamonds media without pH adjustment will result in media with a pH of roughly 6.8. Therefore, we plan to make modifications to the pH to make it be more basic (7.2-7.4), more acidic (6.2), or simply use pH of 6.8, which involves no modification to the original media. The three different pH's of 6.2, 6.8, and 7.2 will provide a broad spectrum to test optimal parasite growth and viability.

Major Objectives

For this project, the objectives were to make diamonds media and be able to apply the appropriate pH modifications of 6.2, 6.8, and 7.2. The next objective was to be able to cultivate and pass Tritrichomonas foetus at the three different pHs. Lastly, we aimed to identify the optimal pH modification which would result in the greatest parasite growth and viability, and quantifying and displaying the different growth rates of the strains at the different pHs to visualize any differences.

Methods (Experimental procedure/design)

There were 4 different Tritrichomonas foetus strains available in the lab, this included KV-1, BP-4, UT-1, and Belfast. The different T. foetus strains were grown in Diamonds media with modified pHs, which included pH 6.2, 6.8, and 7.2. Per week, one strain of T. foetus was thawed and grown at the three different pHs. Growth and analysis for each strain was carried out over a 5-day period. The parasites were also passed each day via a twofold dilution. Cell count via microscope and concentration measurements via flow cytometer were obtained daily. The tube chosen for analysis was that which was most opaque and with the smallest pellet, the dilution factor for the tube chosen was noted. Through cell counting via microscope using the hemocytometer, an approximate parasite concentration of the tube was obtained, the parasite health and viability was also observed. The triplicate cell counts were averaged to obtain an accurate approximation of the parasite concentration within the tube chosen, the approximation was then used to pass a known quantity of parasites via a twofold dilution for that set day. A more accurate cell count and concentration was obtained from the flow cytometer, triplicates for each pH were collected each day. The data obtained from the flow cytometer was analyzed via flowjo, whereas calculations and further analysis was completed through excel where bar graphs depicting the double rate for each strain were created. For each strain, the procedure was repeated for a total of 2 trials, this was performed to ensure repeatability as well as to verify the accuracy of the results.

Results:
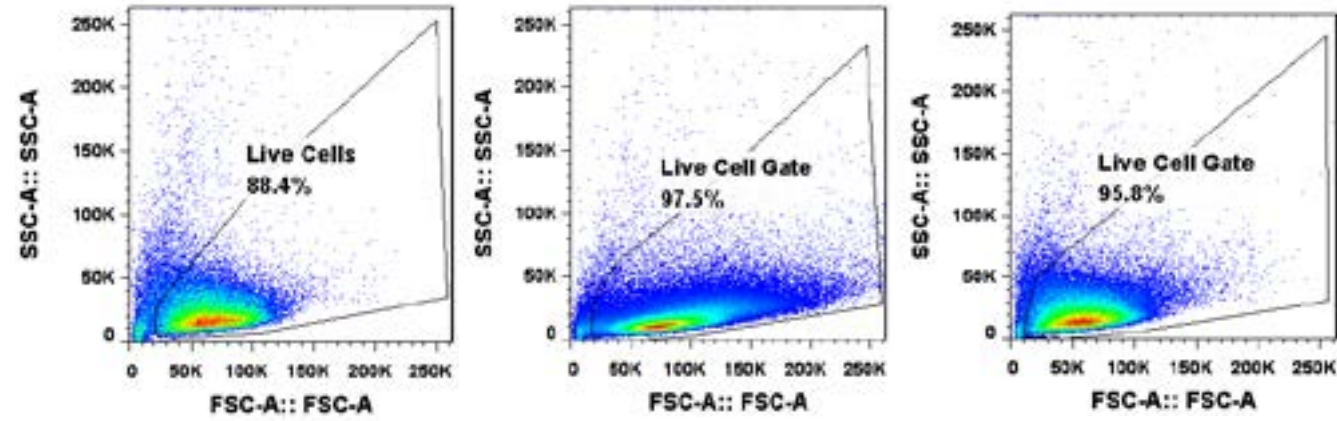
Figure 1. Flow cytometer plot displaying a live cell gate created, to capture the live cell count of a KV-1 sample

Figure 2. Flow cytometer plot displaying a live cell gate created, to capture the live cell count of a BP-4 sample

Figure 3. Flow cytometer plot displaying a live cell gate created, to capture the live cell count of a UT-1 sample
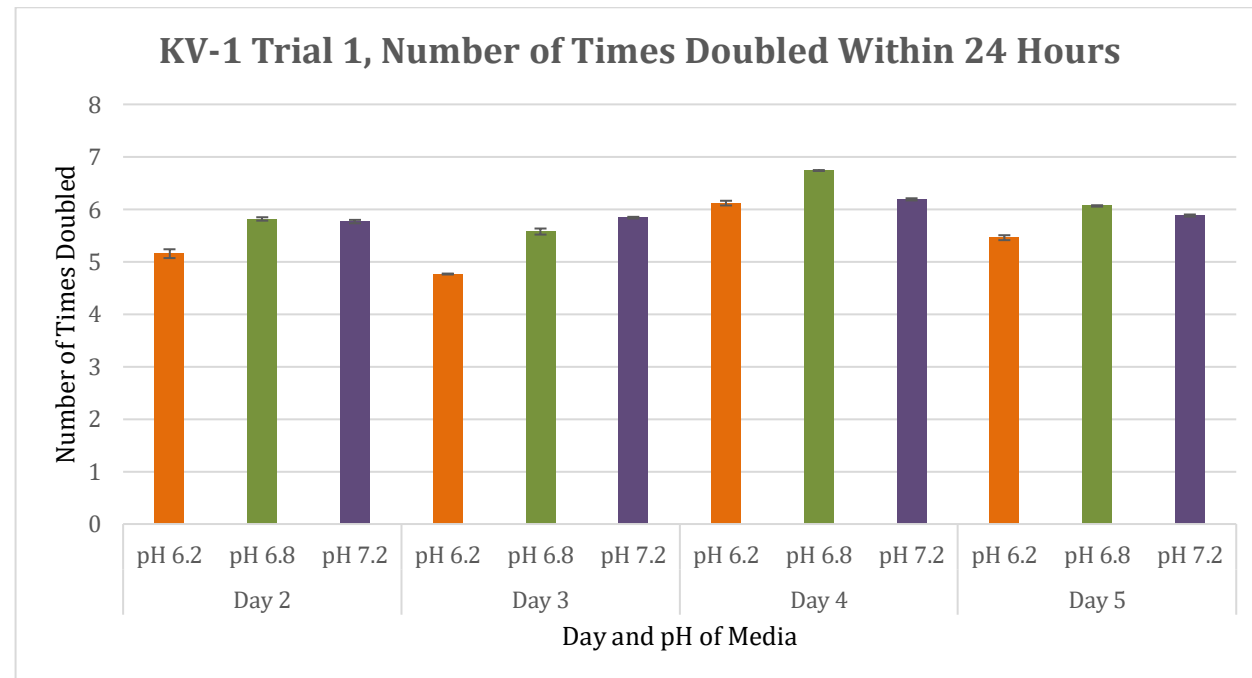
Figure 4. Quantification of data from flow cytometer for the KV-1 strain, 1st trial displaying the number of times doubled within a 24-hour period over 5 days
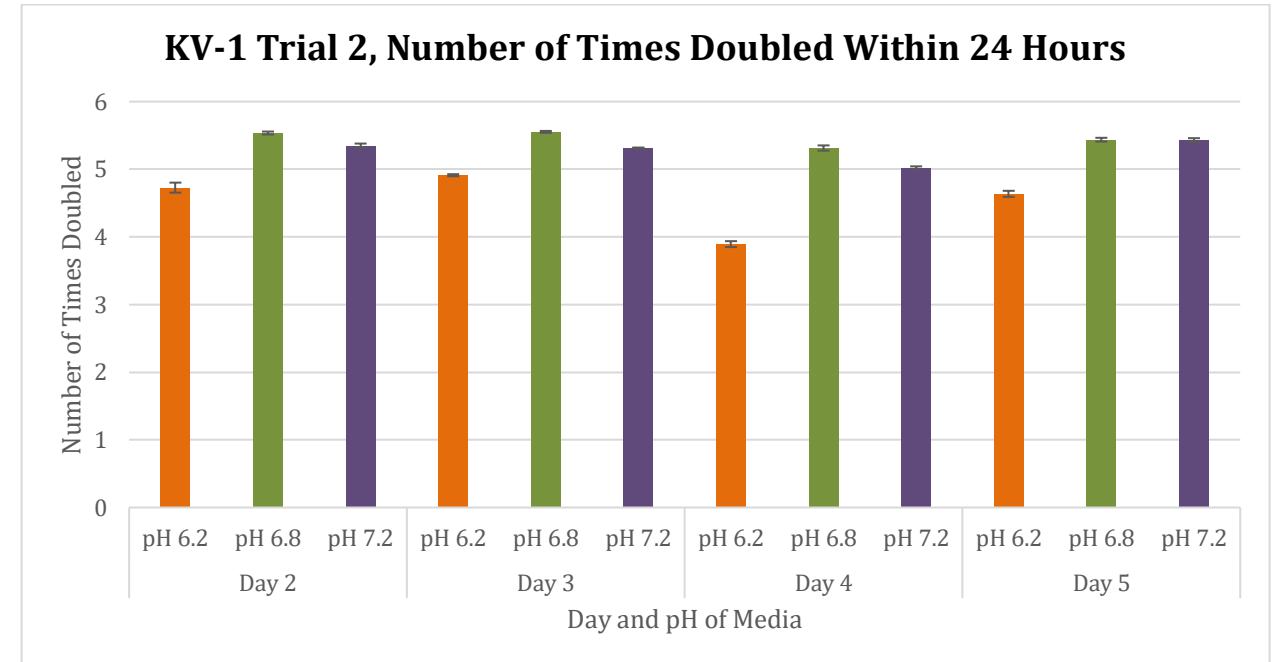
Figure 5. Quantification of data from flow cytometer for the KV-1 strain, 2nd trial displaying the number of times doubled within a 24-hour period over 5 days
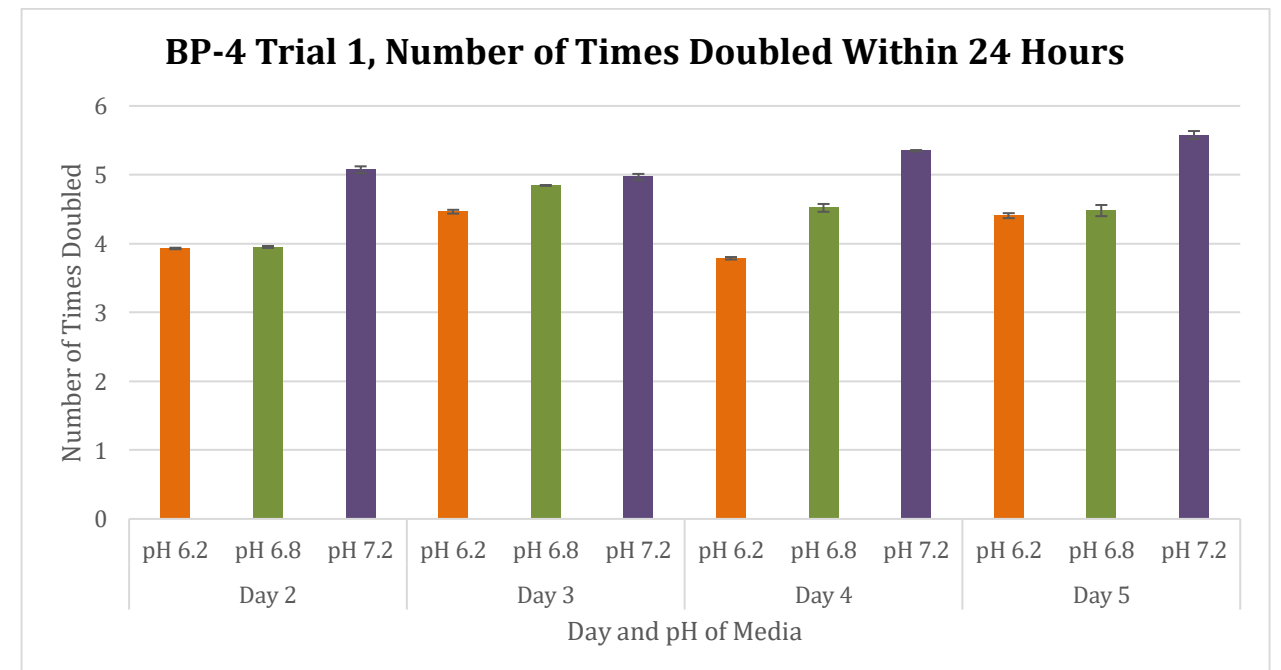
Figure 6. Quantification of data from flow cytometer for the BP-4 strain, 1st trial displaying the number of times doubled within a 24-hour period over 5 days
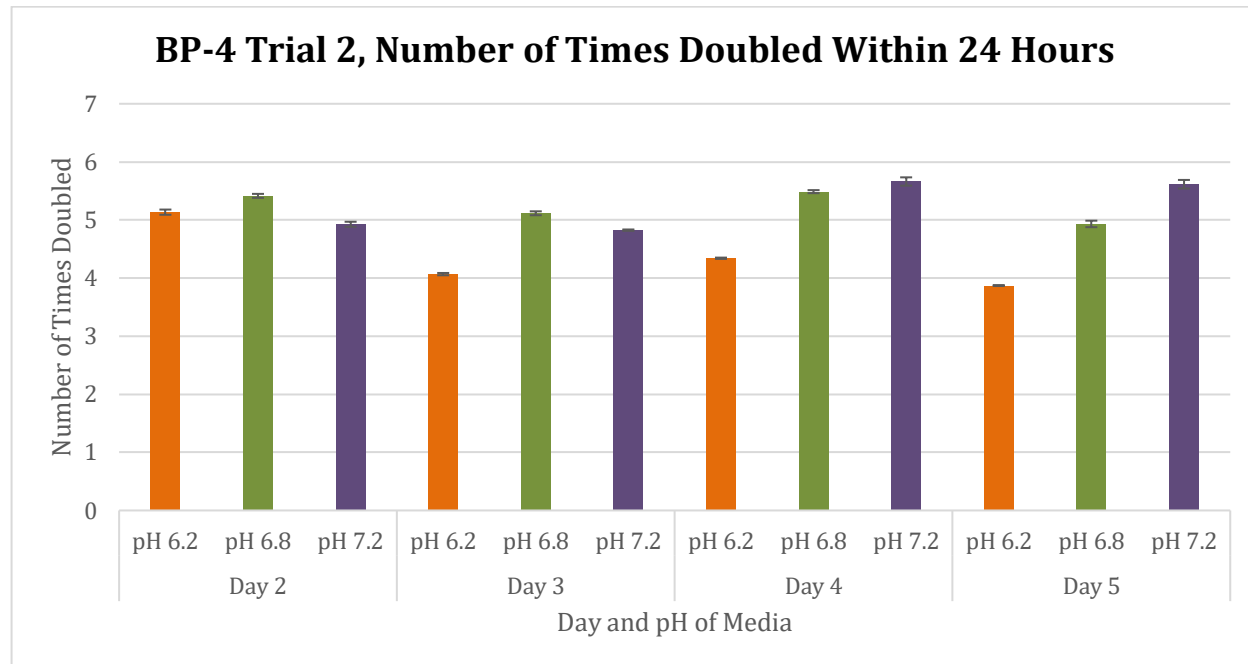
Figure 7. Quantification of data from flow cytometer for the BP-4 strain, 2nd trial displaying the number of times doubled within a 24-hour period over 5 days
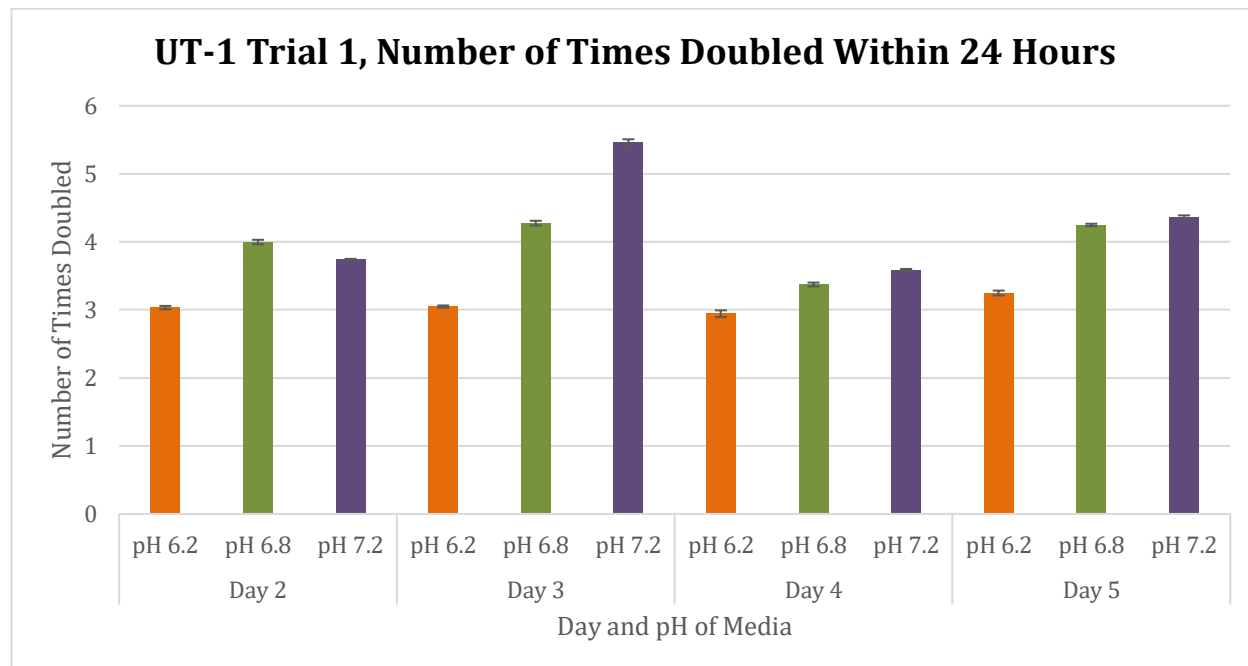
Figure 8. Quantification of data from flow cytometer for the UT-1 strain, 1st trial displaying the number of times doubled within a 24-hour period over 5 days
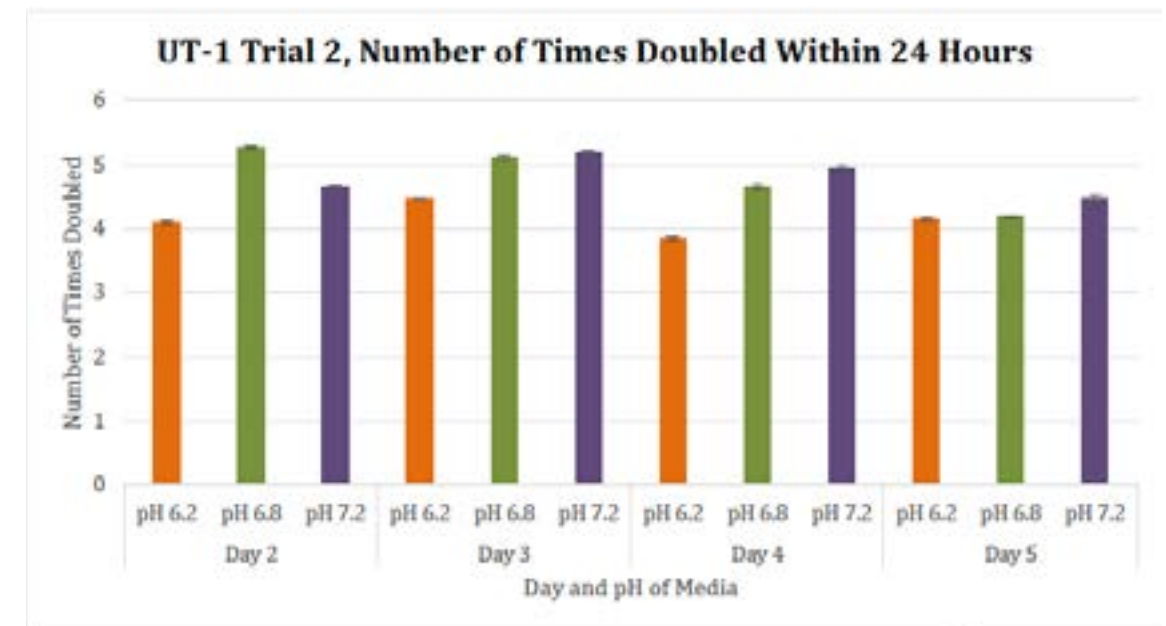
Figure 9. Quantification of data from flow cytometer for the UT-1 strain, 2nd trial displaying the number of times doubled within a 24-hour period over 5 days

Discussion

Beginning with the first strain, KV-1, the first trial of this strain displayed that KV-1 preferred the more basic media, 6.8 and 7.2. This conclusion was made because the number of times doubled within a 24-hour period was greater in the more basic pH media. KV-1 grown in more basic media doubled roughly 6 times within 24 hours whereas in the more acidic media, pH 6.2, the number of times doubled was 5 [Fig. 4]. Repeated for a second trial of KV-1, the results displayed were like that of the first trial. For the second trial the number of times doubled for the more basic media, 6.8 and 7.2, was roughly 5-5.5 times within a 24-hour period. In comparison to the more acidic pH media, 6.2, the number of times doubled was roughly 4-4.5, meaning it's doubling rate was lower than that of the more basic pH media [Fig. 5]. Both trials for the KV-1 strain, displayed that it preferred the more basic pH media, which resulted in it doubling 1 more as many times as that of the more acidic media within a 24-hour period.

Continuing onto the second strain, BP-4, the first trial of this strain displayed that BP-4 preferred basic media, more specifically the pH 7.2 media. When looking at the number of times doubled within a 24-hour period, the parasites cultured in pH 7.2 doubled roughly 5 times. The 7.2 pH media in comparison to the other two pH modifications doubled more frequently. Furthermore, when comparing pH 6.2 and 6.8, there was a slight preference for the 6.8 modification [Fig. 6]. BP-4 appeared to display a preference for basic media, and as when alkalinity increased, so did the number of times doubled. The BP-4 strain repeated for a second trial, the results were similar yet different to that of the first trial. BP-4 displayed a preference for more basic media, however, in comparison to the first trial there was no distinct preference for the pH 6.8 or 7.2, the number of times doubled within 24 hours for the more basic media, 6.8 and 7.2, was roughly 5 times, whereas for the pH 6.2 media, the number of times doubled was roughly 4, less than that of the more basic media [Fig. 7]. Although differences were present in both trial 1 and trial 2 for the BP-4 strain, the

overall pattern, which was a preference for the basic media, was present in both cases.

Lastly with the third strain, UT-1, the first trial displayed a preference for the more basic pH media of 6.8 and 7.2. This was indicated by looking at the number of times doubled per a 24-hour period, where in the more basic media the number of times doubled was much greater than in that of the more acidic pH of 6.2. For both the pH 6.8 and 7.2 media, the number of times doubled was roughly 4, whereas the pH 6.2 media was roughly 3 [Fig. 8]. The procedure was repeated, and the result for the second trial of UT-1 was similar to that of the first trial. Once again, the UT-1 strain displayed a preference and much faster growth in the more basic media. Over the 5-day period the average number of times doubled within 24 hours for the more basic media was roughly 5, whereas the pH 6.2 media doubled roughly 4 times [Fig. 9]. In conclusion, both trials of the UT-1 strain displayed that it had a much greater preference for the more basic media. Cultivation of UT-1 in the more basic media resulting in it doubling 1 more as many times as that in the acidic media.

Overall, across the board for the three strains tested, a preference for the more basic pH media was displayed. With the three strains KV-1, BP-4, and UT-1 doubling 1 more as many times in the basic media, 6.8 and 7.2, in comparison to that of the more acidic media, 6.2. This hypothesis holds true to a certain extent, as the pH 7.2 modification was not the only pH modification to provide significantly greater live cell counts and viability. The pH modification of 6.8 also displayed very similar results to that of the 7.2 pH modification. In conclusion, growth of different Tritrichomonas foetus strains displayed a preference for the more basic pH modification, 6.8 and 7.2, which resulted in a greater live cell count and viability. In the future we hope to carry out the remaining fourth strain, Belfast, and to continue making improvements and modifications to the procedure to improve the accuracy of our measurements as well as for any variation that may be present for different strains.

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Real Olivia

In the context of a pandemic and social development, how do critical events shape political socialization, and influence the political attitudes of generational cohorts?

Abstract

This study uses a cross-sectional design classifying variables of period and cohort effects, exploring the influence through political socialization. This explores the effects of experiencing a series of critical events through an ongoing pandemic and social unrest seen through racial injustices. Generational cohorts are going to be the central unit of analysis, examining the influence of political socialization and political attitudes through the lens of a period effect. Examining generational cohorts through the nature of varying influences of political socialization and critical events, results in heterogeneous effects across individuals across ages in different generations. I will be examining these variables under two themes reflective of the survey questions that will pertain to the ongoing pandemic and social development. I intend on exploring the effects of variables such as remote learning, distribution of vaccines, police brutality, and misinformation. Findings explore how these critical events bring an overall sense of racial group consciousness among ethnic minorities due to the significant influence of social development involving police brutality. This is also found among younger generations having an increased sense of group consciousness among the cohort of younger generations of Gen Z and Millennials. Social media also showed to have a significant influence as an agent of socialization, as this is evident with all generations having an increase in influenced attitudes by misinformation relevant to the ongoing pandemic and developing vaccines.

Introduction

My research question for my senior thesis is, "In the context of a pandemic and social development, how do critical events shape political socialization, and influence the political attitudes of generational cohorts?" I'm interested in how influential the pandemic and social development were in shaping political attitudes through various themes such as group consciousness, police brutality, and the distribution of vaccines. This topic is important to show the influence that is brought by a period effect, in which survey questions will pertain to critical events seen during the ongoing pandemic. In the context of critical events, it's significant to understand the severity of how influential a modern pandemic and racial social unrest are towards collectivity and the political participation of generational cohorts. The causal mechanism of the political socialization of critical events through a contextual period, affects the political attitudes of an individual. Moreover, other factors that are likely to affect the influence towards political attitudes include being an ethnic minority and a household income.

I will be examining the independent variable of the period effect with the dependent variable of generational cohorts pertaining to the ongoing pandemic and social development. The four events that will be the focus of study when it comes to contextual factors surrounding the ongoing pandemic and social development: 1.) The transition to online and remote learning March 13; 2.) The rollout of vaccinations throughout the United States; 3.) The killing of George Floyd; 4.) Social Media is an increasing tool in generating misinformation surrounding the COVID-19 pandemic.

For my argument, I have three hypotheses surrounding critical events that are relevant and greatly influential during the ongoing pandemic. As we continue to live through an ongoing pandemic, I hypothesize that the cause and effect of the relationship between these two concepts will indicate that the more collective an event is felt, the more likely it is going to hold a significant effect on one's political attitudes. I intend on proving my Senior Thesis based on quantitative methods to understand the effects of the pandemic and social development in shaping political behaviors. I plan to create and distribute a survey surrounding questions that pertain to the four critical events that pertain to the ongoing pandemic. I believe this would be a good research design to see which events were more significant to an individual's political attitudes by ejecting a null hypothesis at Ho:p >.05. Hypothesis 1: Those that intersect with younger generations and being an ethnic minority result in the most direct influence on social development and the ongoing pandemic, resulting in the most significant impact of the period effect. Hypothesis 2: Younger generations (Millennials, Gen Z) have the most significant impact on political socialization, increasing group consciousness and influencing political participation. Hypothesis 3: Older generations (Gen X, Baby Boomers) have an increased influence from the media's political socialization surrounding the pandemic and misinformation.

Literature Review

The purpose of this literature review is to create a clear, accurate portrayal of political socialization from the perspective of how critical events influence the political attitudes of generational cohorts and ethnic minorities. The concepts that will be analyzed in regards to their relevance to political socialization are: providing historical context of socialization, the unique socialization that applies to ethnic minorities, and the significance of the period effect on the shaping of one's political socialization. The following two subsections will analyze the contextual factors of the pandemic and social development to support the intended timeline of focus. The first section will give contextual factors of political socialization by 3 socializing agents: family, peers, and the consumption of media. Afterward, the relationship between political socialization and ethnic minorities will be discussed to understand the unique influence critical events have on the marginalized communities most affected. Following will be the analysis of how critical events that form a period effect heavily influence the collective foundation often seen in cohort-centric political attitudes. Further analyzed will be influential events surrounding the pandemic, exploring health disparities surrounding the COVID-19 lockdowns and the development of COVID-19 vaccines. Finally, social development from this given period will be analyzed to further understand the significance of George Floyd's murder, the protests that followed, and how this movement gained significant traction in the global public sphere. As such, I will use the presented literature to provide a substantive foundation for the proceeding quantitative analysis.

2.1 Contextual factors of political socialization: media, family, peers

In the context of the agent of familial political socialization, it is evident that the transmission of intergenerational political attitudes shows a strong lineage concerning their parents and siblings (Jennings & Stoker, 2004, 347). Literature also suggests that although familial intergenerational attitudes hold a significant linkage to attitudes of social trust and civic engagement, it's also evident that some generations are more successfully socialized

via the family (Jennings & Stoker, 2004, 356). Thus, this cohort centric difference in multiple generations within the family can be supported by other members such as siblings, who share core agents of socialization and often develop coherent political attitudes (Eckstein et al., 2018, 395) It's also important to note that young adolescents that have weak family transmission leave them more vulnerable to increasing influence from other agents of socialization. This in turn makes it significant to study cohort-centric political attitudes due to the transition period from adolescence to adulthood ex. Gen Z and Millennials. Through collective memories that many experienced during the pandemic, likely, one's political socialization is greatly influenced by new social circumstances and uncertainties (Jennings & Stoker, 2004, 351). This literature will support further analysis of similarities and variations of generational-centric attitudes. It's also relevant to note that media-based socialization is the most significant method for mitigating disinformation that is relevant to the pandemic (Haase et al, 2021). Given that the world is experiencing a global pandemic, more individuals are integrating technology and the internet into their day-to-day routines. Research before the pandemic suggests that the internet has only been used as a platform that facilitates radicalization, rather than as an influence on radicalization.

The consumption of media is a unique agent of socialization as it has different roles and influential aspects to given generations; where Baby Boomers are far more likely to consume misinformation even though they are the subgroup who has experienced the most personal impact given the higher risk of older individuals and COVID-19 (Lin et. al, 2020). With younger generations being more tech-savvy and fluent on social media platforms, literature also suggests that this can be an upper hand tool used to mobilize and create momentum towards support for similar political attitudes (Sakdiyakorn et al., 2021). Among younger generations, the primary use of the internet has shifted to Tiktok, an app that has created increased collective mobilization given the unprecedented timeline of the past 20 months. Literature has shown that Gen Z has completely embraced Tiktok, and has shown their ability to politically weaponize this collectiveness. This was seen on a large scale in mid-June of 2020 with Tattoo playing a large role in thousands of users requesting huge numbers of tickets for a Trump rally in Oklahoma, only to not turn up, leaving the venue largely empty (Tett, 2020).

With a combination of critical national and global events, these events often hold the personal impact that has been seen as an underlying mechanism that shapes generationally distinct values (Sakdiyakorn et al., 2021). Literature has reflected that platforms have allowed younger generations to generate social awareness of the discourse surrounding racism, international issues, and cultural differences, and ultimately aided in mobilizing voters for the presidential election. Ultimately younger generations such as Gen Z and Millenials have reflected the shaping of collective consciousness that include values of universalism and benevolence, reflecting the significant impact of the pandemic on generational cohort centric groups (Sakdiyakorn et al., 2021). Education being another significant agent of socialization will be relevant to the critical event of the transition to online and remote learning on March 13. However, it will not be a factor used to analyze these instances of political socialization due to the lack of data that explore education as a causal link to one's political attitudes (Berinsky & Lenz, 2010). The environment of the classroom however will be relevant as it plays a significant role in the collective attitudes of individuals in their adolescence (Berinsky & Lenz, 2010).

2.2 Relationship between political socialization and ethnic minorities

Political socialization also holds a unique relationship with ethnic minorities as they are more likely to feel the direct impact of influential critical events. Literature has also shown that within working and urban communities, patterns of social unrest that unravel and expose the large divisions of labor market cleavages and institutionalized racism have a vital role in developing commonality among interclass relations, which largely consist of ethnic minorities (Fantasia, 1995). Recent literature has suggested that ethnic minorities in countries such as Los Angeles County are to face disproportionate effects towards minorities. Continuing to live in a pandemic, we are seeing a large depopulation within the Hispanic and Black communities indicating that minorities are at higher risk to end up with COVID as they are more likely to have essential jobs during the pandemic. With these essential jobs being at higher risk with the newly identified variants in LA County, working-class individuals are seeing increasing disparities that are reflective of the severe health and economic impact of COVID-19 (Zamarripa & Roque, 2021). As Latinos make up a large portion of the essential workforce, they also hold a higher likelihood of being affected due to their continuous exposure to hotspots for transmission (Zamarripa & Roque, 2021).

This recent literature is significant as it indicates that minorities that make up the workforce such as factory workers, child-care workers, grocery store workers, and farmworkers, have all left these individuals at a greater risk to themselves and their families in the time of an ongoing pandemic (Zamarripa & Roque, 2021). Specific minority relationships such as those of Latinx immigrant households are also unique evidence as a mundane form of political socialization holds a significant contribution to establishing that their children take on responsibilities of the household (Carlos, 2021, 776). This in turn heavily affects 1st generation immigrant Americans to politically participate based on critical events that heavily influence their political socialization. However, this becomes a unique familial transmission of attitudes as these younger generations also take on the responsibility of influencing their parents' politics (Carlos, 2021, 776). It is evident that with parents being the strongest agent of influence, for second-generation ethnic minorities such as Latinos and Asians, literature appears to support a prolonged partisan socialization process of 2nd generation immigrant communities (Carlos, 2021, 403). This literature suggests that Millenials and Gen Z individuals just finishing their time of adolescence socialization have yet to show their fullest impact on the "sleeping giant" of political participation involving younger generations of Latinos and Asian families (Carlos, 2021, 403).

2.3 The impact on generational cohorts: critical events in a contextual period and the influence behind the period effect

Generational cohorts have seen collective political attitudes that are greatly influenced by a series of significant critical events. Extensive literature has shown longitudinal experiments of three generations with data largely consisting of Baby Boomers and Gen X. Influential events for the first generation include the Civil Rights Movement, the Vietnam War, the assassination of JFK, and Watergate beginning in the early 1960 s and ended in the early 1970s, significantly shaping the identity of the early Baby Boomers (Jennings & Stoker, 2004, 346). This series of events holds greater influence in

comparison to events Gen X experienced, in which literature shows that they are far less politically active than their parents; this difference, in turn, reflects that significant events surrounding the social development and environmental uncertainty among a given period play a more prominent role in effecting political attitudes (Jennings & Stoker, 2004, 353). This reflects that this specific generational cohort passed the adolescence period has less effect in developing collective values of civic engagement and social trust related to the 80s and 90s period (Jennings & Stoker, 2004, 346). At the beginning of the 21st century, patriotism, political knowledge, and participation were of significant importance with 9/11 creating discourse surrounding ethnic diversity, and efforts of protecting national security (Gimpel et. Al, 2003). This literature is significant to political attitudes after the tragic terrorist attack of 9/11 that was felt globally, which reflects the continuing relevance of The Patriot Act. 20 years later, this large wave of political attitudes surrounding heavier national security shows the role of events of crisis surrounding the collectivity of a generation's political values (Gimpel et. Al, 2003).

2.4 Factors of socialization surrounding the COVID-19 Pandemic

Parental socialization is a heavy influencer when it comes to the formation of left-right political identities, even more, significant now that the pandemic has created discourse surrounding the personal impact and severity of the pandemic (Rico & Jennings, 2016) This evidence of socialization before the pandemic suggest that overall levels of ideology surround how pandemics affect the degree of personal impact and the formation of ideological pathways of western countries (Rico & Jennings, 2016). One of the critical events that reflect this personal impact of transitioning to online and remote learning is the week of March 13, 2020. This transition led to a lack of connectedness in the teacher/student relationship, reflective of the limitations that so many faced abruptly (Parker et. al, 2021). It's also evident that this sentiment is experienced not only at the college level, but both middle school and high school individuals have shown to have a lesser degree of collaboration and common ground due to the ineffectiveness attempts of distance learning (Parker et. al, 2021). Another critical event of focus is going to be the rollout of vaccination throughout the United States. Socioeconomic and racial factors about health disparities affect minorities, lower-income, and the less educated. This literature largely suggests that this skepticism seen through generations of minorities stems from a historical context of institutionalized racism that many have faced in the American health system. It's also evident that medical hesitancy surrounding the vaccine is seen uniquely among minority groups that hold reservations or resistance towards generational trauma many experienced through previous historical events (Lin et. al, 2020). We are seeing now the skewed cases and deaths of Hispanic and African American women, however black women, in particular, have been facing this institutionalized racism that is seen within the healthcare system even before COVID (Bertocchi & Dimico, 2021).

2.5 Significant social development surrounding George Floyd and racial injustice

This is also observed in literature before the pandemic, with political experience largely affecting intergenerational cleavages over the adult life span, suggesting that social development at a younger age reflects the intergenerational attitudes seen as the given generation continues to age (Jennings, 2002). This is evident in previous waves of protest

such as those surrounding the Civil Rights Movement in the 60's era. Early 21st-century literature shows that a sharp rift in a protest era extends to increase political participation and attitudes well into adulthood, showing the longing effects through collective memories of generational cohorts (Jennings, 2002). A significant event that is going to be further analyzed is the killing of George Floyd. In the wake of a pandemic, the summer of 2020 brought a momentum of global protest surrounding the on-camera murder of George Floyd. Literature suggests that these protests create public awareness of structural racism and police brutality, in the effort of improving social development for those most marginalized (Nguyen, 2021). Through these brief months, it's evident that creating a desire for social change is needed to address how black people remain deeply entrenched at the hands of institutionalized racism (Nguyen, 2021). Literature also finds that as this happened during the beginning of the pandemic, it allowed White Americans to recognize the disadvantages minorities face from the direct impact of police brutality surrounding racial inequities (Marshbur, et.al, 2021). This data is unique as it puts racial discourse following the murder of George Floyd and interconnects with other institutionalized forces that affect urban and marginalized communities (Marshbur, et. al, 2021).

Methodology

Generational cohorts will be the central unit of analysis, examining the influence of political socialization and political attitudes through the lens of a period effect. Examining generational cohorts through the nature of varying influences of political socialization results in heterogeneous effects across individuals coming to age in different generations (Weng et. Al 2015). I intend on examining the role of political socialization through various agents of socialization, to explore the relationship between a given generation through a significant event in time. The ages of generational cohorts are:

Generation Z: Born 1997-2012, ages 18 -24
Millennials: Born 1981-1996, ages 25-40
Generation X: Born 1965-1980, ages 41-55
Boomers: Born 1946-64, ages 56-75
Silent: Born 1928-45, ages 76-93

3.1 Defining variables and concepts

The independent variables of the study would be the four topics that pertain to the ongoing pandemic and social development. The dependent variable has four central independent variables that will be the main focus: Gen Z, Millennials, Gen X, and Baby Boomers. I will be examining these variables under two themes reflective of the survey questions that will pertain to the ongoing pandemic and social development. I intend on exploring the effects of remote learning, distribution of vaccines, police brutality, and the role of social media in misinformation. As mentioned in the introduction, the four events of this period's effect are 1.) The transition to online and remote learning March 13; 2.) The rollout of vaccinations throughout the United States; 3.) The killing of George Floyd; 4.) Social Media (Tiktok, Facebook) is a unique tool for generating discourse surrounding racism, and misinformation surrounding the COVID-19 pandemic. First, the ongoing pandemic is about the COVID-19 pandemic that will analyze exploring the most severe effects of the

pandemic. One is health and educational disparities surrounding the COVID-19 lockdown as I intend on implementing questions that pertain to the direct effects of remote learning. I also intend to focus on the rollout of vaccinations as one's political attitudes have an increased possibility of an intense oversaturation of influence stemming from agents of socialization such as family and media. Those surrounding social development pertain to the murder of George Floyd and how social media has contributed to the socialization seen surrounding police brutality. Another significant factor that will be explored is the role of social media and its significant effects on establishing influence.

Data that will be collected will focus on both the period effect of the given time and the cohort effect of the generational cohort as the dependent variable. A period effect describes what often surrounds shits in social, cultural, or economic environments that hold a variation of influence through all age groups simultaneously. This pertains to the subsuming of a complex set of historical events such as the ongoing pandemic and social development that brings this the factor to induce similar changes in the lives of individuals of all ages at this specific point in time (Yang and Land, 2013). These two themes are relevant as they will be reflective of the survey questions seen through the second level of data following demographic and individual data. Thus, period effects are evident to examine now from a current in timing as we are still living through changes in social and epidemiological conditions that influence these critical events (Yang and Land, 2013). A cohort effect surrounds the birth of a cohort, and how they move through the same historical and social events at the same age bringing a variety of experiments. Surrounding the birth of a cohort, the cohort effects examine how this given group moves through the same historical and social events at the same age. Birth cohorts have shown the variation of experiences through different historical and social conditions, examining the influence through various stages of their life (Yang and Land, 2013). The period effect along with the cohort effect will be used to examine the diverse exposure of generational cohorts through a historical context surrounding infectious diseases and social changes (Yang and Land, 2013).

3.2 Plan of Analysis

I intend to study the data through the termed age-period-cohort analysis (Bell and Jones, 2014). I intend to focus on the variables of periods and cohorts with age as an independent context to support the overall variances of the period and cohort effect through generations (Bell and Jones, 2014). This is crucial as it is significant to have a model for both a period and cohort effect to examine the political socialization of political attitudes of this period in time. To cross classify period effects and cohort effects will allow me to explore data across variables that result in a more prominent impact of influence on a given generation. As I will be using a cross-sectional design, it is going to be difficult to demonstrate the cause and effect resulting in political attitudes but it allows me to examine particular behaviors that might be linked to a particular variance of an agent of socialization. However, it is important to examine the direct reflection of attitudes relevant to this particular point in time. Examining data that cross-classifies age, period, and cohort, allows there to be individual-level variables that capture the period and cohort effects under the nature of cross-classified contextual-level variables (Weng et. Al 2015). Using a cross-sectional design will allow for data to examine through age, period, and cohort effects that collectively shape the political socialization of a given generation (Weng et. Al 2015).

Findings

I intend to discuss results grouped by hypotheses and discuss findings accordingly. I have tested several independent variables, along with several controlled dependent variables. Again, for every independent variable, the dependent variable was used to measure the extent of influence in the context of critical events during an ongoing pandemic. Further, I will mention the dependent variables used, and whether variables were significant in terms of the given hypothesis.

4.1 Descriptive Statistics of the study sample

Table 1A. Descriptive Statistics N=697		
Variables	**Percent of Sample**	**Sample Value**
1.1 Generations/Age		
Gen Z: 18-24	24%	143
Millennials: 25-40	28%	166
Gen X: 41-55	29%	173
Baby Boomers: 56-75	17%	104
Silent Generation: 76 or older	2%	10
1.2 Ethnicity- How would you describe yourself? Select all that apply.		
Hispanic or Latino	42%	279
White	39%	259
Asian	9%	57
Other	5%	32
Black or African American	3%	17
American Indian or Alaska Native	2%	11
Native Hawaiian or Pacific Islander	1%	4
1.3 Household Income		
Less than $25,00	10%	56
$25,000 to $34,999	9%	51
Poverty Line	--------------	--------
$35,000 to $49,999	11%	62
$50,000 to $74,999	16%	94
$75,000 to $99,999	16%	91
$100,000 to $149,999	19%	110
$150,000 or more	19%	108

Table 1A depicts three categorical subcategories of descriptive factors of the study sample. With the survey closing on March 27, 2022, 697 respondents' were the final sample size of the study.

Descriptive data is first examined through generation, with 1.1 Generations/Age showing age, name, and percentages of the given generations that make up the generational cohorts within the sample. There was an average of 24.5% representation for the four main generations centered in the study. The variable of Gen Z made up 24%, Millennials 28%, Gen X 29%, and Baby Boomers at 17%. The 2% of Silent Generation data was not taken into account given the minimal representation within the sample size. 1.2 Ethnicity- How would you describe yourself? Select all that apply. is the following category, with the largest category being 42% of all respondents describing themselves as Hispanic or Latino. The representative data that pertains to ethnicity was separated into ethnic minorities and not ethnic minorities. 39% of the sample size was white respondents, and ethnic minorities made up 59% of all respondents. The final descriptive category is 1.3 Household Income, with an average sample size of 14% representation of the presented income brackets, 10% of respondents make less than $25,000 annually, followed by 9% of respondents making between $50,000 to $74,999 annually. These two sub-categories were examined as the singular variable of "Less than 35k" to further analyze data below or above the California poverty line (Bohn et al., 2021). I will be examining Hypothesis 1 and 2 regarding socioeconomic status in the context of poverty to focus on the direct effects the COVID-19 pandemic has had on marginalized communities (Bohn et al., 2021).

4.2 Hypothesis 1: Those that intersect with younger generations and being an ethnic minority result in the most direct influence during an ongoing pandemic, resulting in the most significant impact of the period effect.

Hypothesis 1 aims to explore if those that intersect ethnic minorities and younger generations have felt a more significant impact of critical events presented during the period effet of an ongoing pandemic. The reported findings show the least statistical significance for the first hypothesis. The two tables that examine the cross-tabulations for Hypothesis 1 are looking for an observed difference with the intention of rejecting the null hypothesis. Ho:p >.05: No statistically significant difference between generational cohorts, ethnic minorities, and nonethnic minorities. The alternative hypothesis H1:p ≤ .05 shows a statistically significant difference between the subgroups of 1. younger generations, 2. ethnic minorities, and 3 non-ethnic minorities with having the most significant impact on the current period effect of the COVID-19 pandemic. The p-value of each given variable is examined at a significance level of α = 0.05 to determine statistical significance.

Table 2A. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.06	1.07	670
Gen Z	0.42	0.58	0.09	1.04	143
Millennials	0.37	0.63	0.09	1.08	166
Hispanic	0.36	0.65	0.08	1.13	279
Black	0.23	0.77	0.22	0.84	17
Asian	0.45	0.55	0.15	1.11	57
White	0.19	0.19	0.08	1.09	259
Less than 35k	0.43	0.23	0.11	1.01	107
More than 35k	0.38	0.62	0.06	1.1	465

No variables statistically significant at p<.05.

Table 2A documents results of respondents' to the following question: How often does family influence you political participation?

Table 2B. Independent Variables	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.07	1.45	609
Gen Z	0*	1	0.19	1.05	143
Millennials	0.12	0.88	0.13	1.47	166
Hispanic	0.17	0.83	0.1	1.43	279
Black	0.23	0.77	0.38	1.55	17
Asian	.05*	0.95	0.17	1.22	57
White	0.12	0.88	0.11	1.47	259
Less than 35k	0.0005*	0.99	0.13	1.25	107
More than 35k	0.25	0.75	0.11	1.46	465

* Statistically significant at p <.05.

Table 2B. documents the results of respondents' to the following statement: The killing of George Floyd has shown me the severity of police brutality.

In the context of Table 2A, all independent variables examine the population size of respondents to How often does family influence your political participation? This question was specifically asked to study if there is any significant influence on any of the listed independent variables. This question was specifically asked to examine if there is any significant influence on any of the listed independent variables. When examining the data in Table 2A, it is evident that the p-values are not of statistical significance to any of the variables. Therefore failing to reject the Null Hypothesis due to the lack of statistical significance at α = 0.05. However, these findings also present that white respondents have a slightly greater statistical significance in comparison to the p-values from ethnic minorities. This is seen with the p-value for White (.19)>.05 in comparison to the p-values of Hispanics (.36), Black (.23), and Asian (.45)>.05 respondents. This suggests that white individuals have a higher influence on their political participation from the agents of socialization of family, but show no statistical significance among the sample observed.

When examining the data in Table 2B, it is evident that the p-values of variables, Gen Z, Asian, and Less than 35k, are of statistical significance at the statistical significance level of α = 0.05. The p-values of the independent variables of Gen Z H1:(0) ≤ .05, and Less than 35k H1: (.0005) ≤ .05, show that these two variables present a highly significant statistical level. The Asian variable is also equal to the null hypothesis H1:(.05) ≤ .05, showing a significant statistical level at H1:p ≤ .05. In turn, this leads to rejecting the Null Hypothesis as statistical significance in the context of H1:p ≤ .05. These results are interesting in examining various generational cohorts, with Generation Z being the most influenced generation in the context of seeing the George Floyd murder as the critical event that shows the severity of police brutality. This is an interesting finding as the Gen Z respondent's ages range from 18 to 24 in the sample, following their adolescence into the prime age of political influence of early adulthood. This in turn suggests that the murder of George Floyd and the movement that followed significantly influenced showing Gen Z the severity of police brutality. The variable of the Less than 35k income subgroup is also interesting when examining the oversaturation of policing within low-income communities. These significant findings also suggest that established quotas in over-policed neighborhoods show a higher rate of police brutality given incentives instilled to meet established quotas. In turn, low-income communities that are significantly more policed have a more significant influence on the severity of police brutality in underrepresented low-income home communities. Respondents also show a significant luencece from the killing of George Floyd, suggesting that the Stop Asian Hate hate crimes that occurred following the summer BLM movement brought more influence in showing the severity of police brutality. The remaining variables accepted the Null Hypothesis at H1:p ≤ .05 as not statistically significant. Observing the p-values that weren't statistically significant, black respondents Ho (.23)>.05 have the highest p-value of ethnic minorities, compared with white respondents Ho (.12)>.05. This may suggest that white people were more influenced by the murder of George Floyd,

suggesting that black respondents already understand the extent of police brutality in black communities (Nguyen, 2021).

4.3 Hypothesis 2: Younger generations (Millennials, Gen Z) have the most significant impact on political socialization, increasing group consciousness and political participation.

For the second hypothesis, the reported findings are shown to be statistically significant in 2/4 of items examined for hypothesis 2(H2). This report generally focused on generations as a whole and examined the generational differences of the given item, specifically among Gen Z and Millenials. The items are studied through 4 tables that examine the cross-tabulations for Hypothesis 2 that are looking for an observed difference to reject the null hypothesis. Ho:p >.05: No statistically significant difference in influence on political socialization, resulting in no change in group consciousness or increase in political participation. The alternative hypothesis H1:p ≤ .05 shows a statistically significant differentiation between the generational cohorts in two subgroups of 1. younger generations (Gen Z, Millennials), 2. older generations (Gen X, Baby Boomers), resulting in an increase in group consciousness and political participation. The p-value of each given variable is examined at a significance level of α = 0.05 to determine statistical significance.

Table 3A. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.04	0.81	689
Gen Z	0.005*	1	0.07	0.79	143
Millennials	0.01*	0.99	0.07	0.83	166
Gen X	0.5	0.5	0.08	0.77	173
Baby Boomers	0.32	0.69	0.08	0.77	103
Less than 35k	0.03*	0.97	0.08	0.76	107
More than 35k	0.27	0.73	0.05	0.81	465

* Statistically significant at p <.05.

Table 3A. documents the results of respondents' to the following statement: I identify with the collective experiences of my generation.

When examining the data in Table 3A, the respondents surround the presented variables and the statistical significance level of collectivity among generational cohorts. With a sample size of 689 respondents, the p-values of Generation Z, Millennials, and those that make Less than 35k are all highly significant at the significance level of α = 0.05. The p-values of the independent variables of Gen Z H1:(.005) ≤ .05, and Millennials (.01) ≤ .05, showing that the influence of collective generational experiences is present at a highly significant statistical level. The variable of those that make less than 35k is (.05) ≤ .05, showing a significant statistical level at H1:p ≤ .05. In turn, this leads to rejecting the Null Hypothesis among these three variables as statistical significance in the context of H1:p ≤ .05. These results show younger generations having a higher statistical significance, with Gen Z being the most collective generation in the context of generational experiences that

pertain to a given cohort. This data gives supporting context to Gen Z being the most collective and similar generation thus far, showing the smallest range of respondents surrounding collective experiences. This also suggests that with Gen Z entering early adulthood, and Millennials being in their late 20s, it's evident that younger generational cohorts feel the most collective having lived the smallest number of years compared to older generations (Berinsky & Lenz, 2010). This further supports the rejecting of the H2 Null Hypothesis that younger generations have more group consciousness given their highly significant statistical level of collectivity at H1:p ≤ .05. The remaining variables of Gen X, Baby Boomers, and those that make More than 35k failed to reject the Null Hypothesis as not statistically significant at H1:p ≤ .05.

Table 3B. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.07	1.19	630
Gen Z	0.32	0.68	0.11	1.14	143
Millennials	0.38	0.62	0.1	1.15	166
Gen X	0.5	0.5	0.11	1.26	173
Baby Boomers	0.12	0.88	0.12	1.12	103
Less than 35k	0.4	0.61	0.12	1.15	107
More than 35k	0.45	0.55	0.07	1.18	463

No variables statistically significant at p<.05.

Table 3B. documents the results of respondents' to the following statement: The transition to online learning has increased my political participation.

Examining the data in Table 3B, it is evident that the p-values are not of statistical significance to any of the variables, failing to reject the Null Hypothesis for all presented variables as not statistically significant at H1:p ≤ .05. This item was asked to study if the disruptive transition to online learning influenced the political participation of generational cohorts, anticipating that younger generations had an increase in political participation. It is however interesting that Baby Boomers have the most significant p-value (.12) > .05, compared to the p-values of the younger generation with Gen Z H1:(.32) > .05, and Millennials (.38) ≤ .05. In turn suggesting that younger generations, who are commonly at the college level, are less likely to be influenced by the transition to online learning (Parker et. al, 2021).

Table 3C. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.06	1.3	621
Gen Z	0.4	0.6	0.11	1.21	143
Millennials	0.33	0.67	0.12	1.33	166
Gen X	0.24	0.76	0.11	1.34	173
Baby Boomers	0.36	0.64	0.14	1.3	104
Less than 35k	0.38	0.62	0.13	1.26	107
More than 35k	0.4	0.6	0.08	1.3	465
No variables statistically significant at p<.05.					

Table 3C. documents the results of respondents' to the following statement: The rollout of vaccines has influenced

an increase in my political participation.

When examining the data of the statement: The rollout of vaccines has influenced an increase in my political participation. Shown in Table 3C, it is evident that the p-values are not of statistical significance to any of the variables, failing to reject the Null Hypothesis for all presented variables as not statistically significant at H1:p ≤ .05. This is seen comparing the p-values of Generational Cohorts: Gen Z (.4), Millennials (.33), Gen X (.24), and Baby Boomers (.36)at Ho p >.05. This suggests that the current event influence of an ongoing pandemic and the production of vaccines has not been a significant influence on group consciousness or political participation.

Table 3D. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.07	1.35	609
Gen Z	0*	1	0.11	1.16	143
Millennials	0.31	0.7	0.11	1.28	166
Gen X	0.14	0.86	0.12	1.38	173
Baby Boomers	0.002*	1	0.14	1.35	104
Less than 35k	0.006*	1	0.14	1.36	107
More than 35k	0.31	0.69	0.08	1.34	465
* Statistically significant at p <.05.					

Table 3D. documents the results of respondents' to the following statement: The killing of George Floyd has

influenced an increase in my political participation.

When studying the respondents' statement, The killing of George Floyd has influenced an increase in my political participation, this data shows to be the most statistical significance to H2. With a sample size of 621 respondents, Table 3D, shows the p-values of Generation Z, Baby Boomers, and those that make Less than 35k all as highly significant at the significance level of α = 0.05. The p-values of the independent variables of Gen Z H1:(0) ≤ .05, and Baby Boomers (.002) ≤ .05, show the variation of influence of increased political participation in both young and older generations. The variable of those that make less than 35k is (.006) ≤ .05, showing a highly significant statistical level at H1:p ≤ .05. In turn, this leads to rejecting the Null Hypothesis among these three variables as statistical significance in the context of H1:p ≤ .05. This data, in turn, suggests that the murder of George Floyd also had a signficant influence on generational cohorts of all ages, further supporting the increase of political participation through the period effect of critical events and an ongoing pandemic (Jennings, 2002). The remaining variables of Millennials, Gen X, and those that make More than 35k failed to reject the Null Hypothesis as not statistically significant at H1:p ≤ .05.

4.4 Hypothesis 3: Older generations (Gen X, Baby Boomers) have an increased influence from the media's political socialization surrounding the pandemic and misinformation.

Hypothesis 3 aims to explore if there is an increased influence from social media surrounding the pandemic and misinformation. This hypothesis aims to explore if misinformation varies from the generational cohort, and if there has been an increase in the influence of misinformation relevant to masks, vaccines, the origin of COVID-19, etc. Data collected for H3 were found to have the most collectivity among generations, resulting in the most statistical significance out of the 3 hypotheses explored for this study. The four tables that examine the cross-tabulations for Hypothesis 3 are looking for an observed difference to reject the null hypothesis. Ho:p >.05: No statistically significant difference between generational cohorts, with no increase from social media, surrounding the pandemic and misinformation. The p-value of each given variable is examined at a significance level of α = 0.05 to determine statistical significance.

Table 4A. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.07	1.41	621
Gen Z	.002*	0.95	0.13	1.21	143
Millennials	0.001*	1	0.11	1.38	166
Gen X	0.05*	0.95	0.13	1.34	173
Baby Boomers	0.05*	0.95	0.14	1.34	104
Less than 35k	0*	1	0.14	1.34	107
More than 35k	0.45	0.55	0.09	1.42	465
* Statistically					

significant at p <.05.

Table 4A. documents the results of respondents' to the following statement: The rollout of the Pfizer, Moderna, and

Johnson & Johnson vaccines, have done more good than harm.

When examining the data of the item asked: The rollout of the Pfizer, Moderna, and Johnson & Johnson vaccines, has done more good than harm. With a sample size of 621 respondents, the p-values of Generation Z, Millennials, Gen X, Baby Boomers, and those that make Less than 35k are all highly significant at the significance level of α = 0.05. It is evident that the p-values for the independent variables of Gen Z (.002) ≤ .05, Millennials (.001) ≤ .05, and those that make Less than 35k (.0) ≤ .05, show that these two variables present a highly significant statistical level. The variable of Gen X (.05) ≤ .05 and Baby Boomers (.05) ≤ .05, showing a highly significant statistical level at H1:p ≤ .05. In turn, this leads to rejecting the Null Hypothesis among these five variables as statistical significance in the context of H1:p ≤ .05. The remaining variable of more than 35k clear outlier to the overall significance of the other independent variables was found to not be statistically significant and did not reject the null hypothesis. These findings show Gen Z and Millennials having similar p-values, similar to how Gen X and Baby Boomers have close-range p-values to one another, showing the variation of influence of increased opinions surrounding vaccines in both young and older generations (Lin et. al, 2020). The results of these variables can also be seen in Table 4A.

Table 4B. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.05	1.36	602
Gen Z	0*	1	0.11	1.14	143
Millennials	0.03*	0.97	0.12	1.42	166
Gen X	0.0001*	1	0.11	1.3	173
Baby Boomers	0.0003*	1	0.14	1.26	104
Less than 35k	0.05*	0.95	0.14	1.35	107
More than 35k	0.36	0.64	0.08	1.36	465
* Statistically significant at p <.05.					

Table 4B. documents the results of respondents' to the following statement: Younger generations consume more misinformation than older generations.

When examining the data in Table 4B, the 602 respondents' examined if they believed that younger generations consume more misinformation than older generations. The p-values of Generation Z, Millennials, Gen X, Baby Boomers, and those that make Less than 35k are all highly significant at the significance level of α = 0.05. It is evident that the p-values for the independent variables of Gen Z (0) ≤ .05, Millennials (.03) ≤ .05, Gen X (.0001) ≤ .05, and Baby Boomers (.0003) ≤ .05 show that these four variables present a highly significant statistical level. The variable of those that make less than 35k (.05) ≤ .05, showing a significant statistical level at H1:p ≤ .05. In turn, this leads to rejecting the Null Hypothesis among these five variables as statistical significance in the context of H1:p ≤ .05.

This data suggests that generational cohorts collectively hold similar opinions that younger generations consume more misinformation than older generations (Sakdiyakorn et al., 2021). This continues to show that various generations hold similar values in the context of increased consumption of misinformation during an ongoing pandemic.

Table 4C. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.05	1.31	602
Gen Z	0*	1	0.1	1.02	143
Millennials	0.08	0.92	0.11	1.26	166
Gen X	0.07	0.93	0.11	1.32	173
Baby Boomers	0*	1	0.14	1.3	104
Less than 35k	0.002*	1	0.12	1.16	107
More than 35k	0.31	0.69	0.08	1.31	465
* Statistically significant at p <.05.					

Table 4C. documents the results of respondents' to the following statement: Older generations consume more misinformation than younger generations.

When examining the data of the item asked: Older generations consume more misinformation than younger generations. With a sample size of 602 respondents, Table 4C shows the p-values of Generation Z, Baby Boomers, and those that make Less than 35k are all highly significant at the significance level of α = 0.05. It is evident that the p-values for the independent variables of Gen Z (.0) ≤ .05, Baby Boomers (0) ≤ .05, and those that make Less than 35k (.002) ≤ .05, show that these two variables present a highly significant statistical level. In turn, this leads to rejecting the Null Hypothesis among these three variables as statistical significance in the context of H1:p ≤ .05. The remaining variables of Millennials, Gen X, and those that make More than 35k failed to reject the Null Hypothesis as not statistically significant at H1:p ≤ .05. The p-value for both Gen Z and Boomers is (0) ≤ .05., indicating that the data shown in Table 4C has the most collective response that the general consensus is that the COVID-19 vaccines have done more good than harm (Lin et. al, 2020). The p-values across generations are also more significant than the data seen in Table 4B.

Table 4D. Independent Variable	P-Value	Significant Value	Standard Error	SD	N
Constant	0.5	0.5	0.04	1.03	670
Gen Z	0*	1	0.1	1.07	143
Millennials	0.36	0.64	0.09	0.99	166
Gen X	0.005*	0.99	0.08	0.93	173
Baby Boomers	0.002*	1	0.09	0.85	104
Less than 35k	.009*	0.99	0.11	1.08	107
More than 35k	0.44	0.56	0.06	1.01	465

* Statistically significant at p <.05.

Table 4D. documents the results of respondents' to the following statement: How often does social media influence your political participation?

When examining the data in Table 4D, the 670 respondents' to How often does social media influence your political participation?. The p-values of Generation Z, Gen X, Baby Boomers, and those that make Less than 35k are all highly significant at the significance level of α = 0.05. It is evident that the p-values for the independent variables of Gen Z (0) ≤ .05, Gen X (.005) ≤ .05, Baby Boomers (.002) ≤ .05, and those that make less than 35k (.009) ≤ .05, are highly significant at the statistical level significance level of α = 0.05. In turn, this leads to rejecting the Null Hypothesis among these five variables as statistical significance in the context of H1:p ≤ .05. The remaining variable of more than 35k clear outlier to the overall significance of the other independent variables was found to not be statistically significant and did not reject the null hypothesis. The remaining variables of Millennials, and those that make More than 35k failed to reject the Null Hypothesis as not statistically significant at H1:p ≤ .05.

Conclusion

The significance of this project is to further understand how significant of an impact the COVID-19 pandemic continues to be on the political participation of generational cohorts. With Hypothesis 1 and 2 being statistically significant, and Hypothesis 3 as highly significant, it is evident that further research to explore how the period effect plays a role in influencing group consciousness and political participation. In Hypothesis 1, it is evident that the murder of George Floyd held. significant influence towards understanding the severity of police brutality. Hypothesis 2, suggests that there is a statistical significance found among younger generations having an increased sense of group consciousness in generational cohorts. For the final hypothesis, H3 proves that social media has had a variation of influence through generations, suggesting there to be an increased influence by misinformation relevant to the ongoing pandemic.

This analysis identifies the influence that is found through generational cohorts, specifically how Gen Z has shown to have the most increased sense of group consciousness in the context of a pandemic. The agent of socialization of social media has also been shown to have the most significant impact of influence on political participation. I intend to continue my future research objectives in exploring the complexity of long-term political socialization to study several measures of data over time and across generations, as I believe it is important to examine the direct reflection of attitudes through the variation of influence towards a given generation. This inquiry explores political socialization from the perspective of how critical events influence the political attitudes of generational cohorts. In the historical context of epidemiological conditions that influence these critical events, American politics is shaped through period and cohort effects that surround the variation of political experiences. Living through an ongoing pandemic, it's evident that a complex series of historical events holds a significant influence on all age groups through the lens of generational cohorts.

Appendix

Figure 6A. Collectivity 1-presents a bar graph of responses to the following statement that pertains to collectivity: I identify with the collective experiences of my generation.

Figure 6B. Floyd 3-presents a bar graph of responses to the following statement that pertains to George Floyd and social unrest: The killing of George Floyd has influenced an increase in my political participation.

Figure 6C. Rollout 1 -presents a bar graph of responses to the following statement that pertains to vaccines produced during the ongoing pandemic: The rollout of the Pfizer, Moderna, and Johnson & Johnson vaccines, has done more good than harm.

Figure 6D. Misinformation 1 -presents a bar graph of responses to the following statement that pertains to social media misinformation: Younger generations consume more misinformation than older generations.

Figure 6E. Misinformation 2 -presents a bar graph of responses to the following statement that pertains to social media misinformation: Older generations consume more misinformation than younger generations.

Figure 6F. Agent 3 -presents a bar graph of responses to the following question that pertains to social media as anagent of socialization: How often does social media influence your political participation?

Figure 6A.

Figure 6B.

Figure 6C.

Figure 6D.

Figure 6E.

Figure 6F.
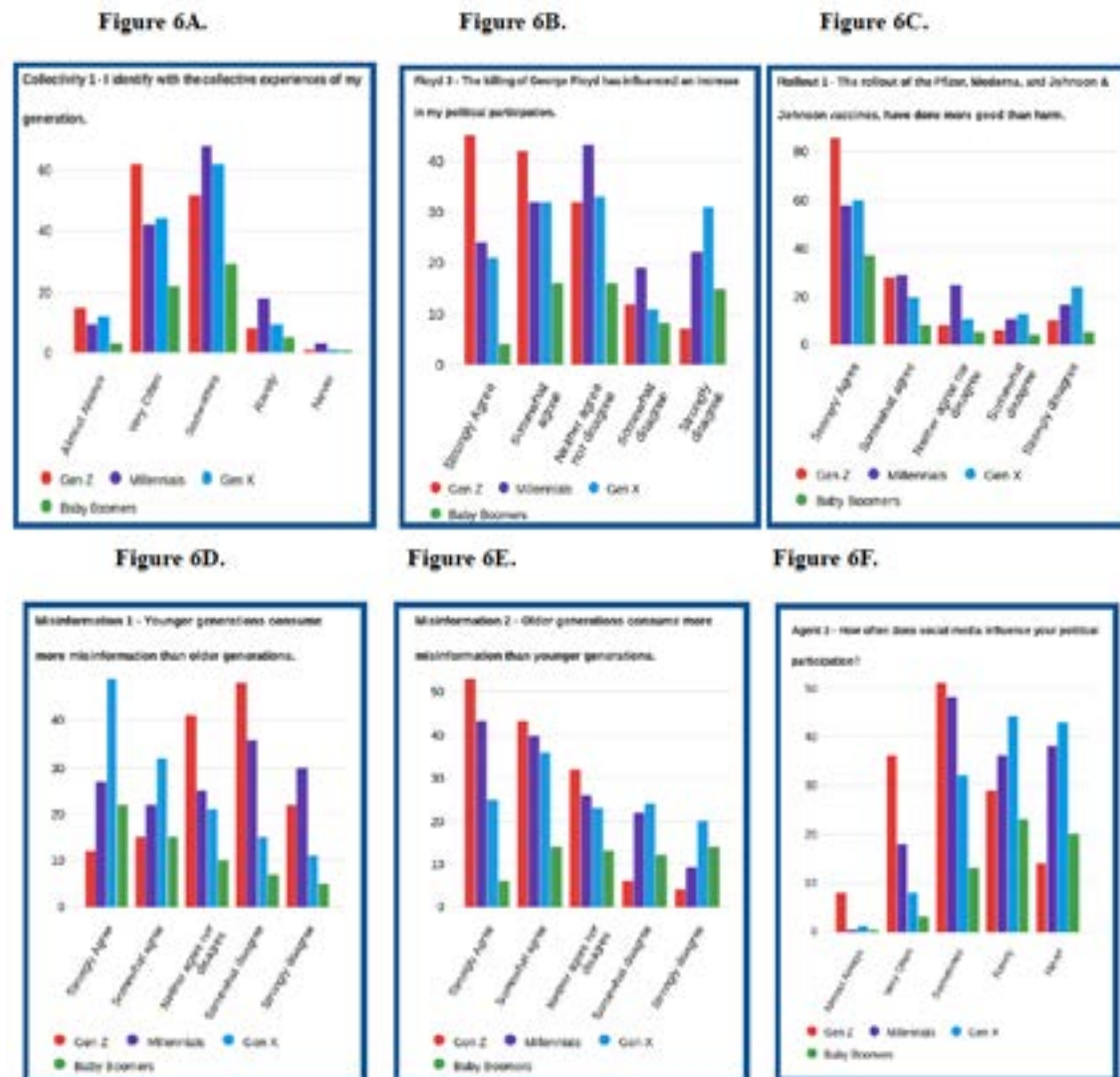
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Reeve
Alan

Mapping Suitability of Walnut Crops in California: Using Spatial Models to Project Suitability Under Climate Scenarios

Abstract

Climate change is becoming more apparent as the world begins to experience more extreme temperature events and unpredictable weather patterns. This is especially true for California in the form of severe drought, which has been a limiting factor for the agricultural industry. Environmental variables such as precipitation and temperature extremes pose a threat to the cultivation of walnuts in California. A species distribution model (SDM), MaxEnt, was used to predict changes in the areas suitable for growing walnuts based on environmental variables that are predicted by climate change models, general circulation models (GCM), developed for the Intergovernmental Panel on Climate Change (IPCC, 2021). Based on four GCMs and the shared socioeconomic pathway 5-8.5 (SSP 5-8.5), results show a severe reduction in area suitable for growing walnuts: (1) 50.2% reduction by 2040-2060, and (2) 51.2% reduction by 2080-2100.

Introduction

The sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC), published in 2021 (IPCC, 2021), has assimilated even stronger evidence to support the unequivocal connection between human-induced climate change and the widespread changes occurring in today's weather and climate patterns. Given the current rate of emissions, it is estimated that global temperatures will increase between 1.5 °C and 2 °C by 2060 (IPCC, 2021). The rise in temperature has severe implications on agriculture and there is growing evidence that climate change is starting to exert an overwhelming negative effect on crop yield trends (Lobell et al., 2011). Temperature change is especially impactful for specialty crops in California when combined with severe droughts and the overreliance on groundwater.

As one of these specialty crops, walnuts are among California's most profitable crops. The past decade has seen a large increase in production, averaging annually at 500,000 tons which is valued to be around a billion dollars (California Department of Food and Agriculture, 2020). With climate change becoming more apparent, lack of precipitation and temperature extremes are posing a threat to the cultivation of walnuts in California. By taking advantage of recent climate change science, we can reliably estimate the suitability of walnut crops in California.

To achieve this, we used a Species Distribution Model (SDM) to determine current and future distribution of walnut crops. Species distribution modeling has mostly been used in areas of research such as conservation biology and ecology but has recently been adapted for use in studying distributions of agricultural crops (Akpoti, 2020; Caetano, 2018; Khalil, 2021; Shi, 2021; Su, 2021; Wang, 2018). SDMs correlate species occurrence data with environmental variables, such as climate and topography. Based on given changes to these environmental variables, the SDM is then able to predict potential distributions of the target species. SDMs are sometimes also referred to as bioclimatic models, climate

envelopes, ecological niche models (ENMs), habitat models, resource selection functions (RSFs), and range maps (Elith & Leathwick, 2009).

The SDM we used is MaxEnt (Phillips and Dudík, 2008), a model that uses a machine learning algorithm based on the principle of maximum entropy. Of the many SDMs available, MaxEnt is one of the more widely used. Compared to other algorithms, MaxEnt has shown to be more accurate in its predictions (Charre-Medellín et al., 2021; Feng et al., 2021; Tang et al., 2021). It is also robust, showing high predictive performance despite spatial errors and geographic bias in occurrence data (Ratnayake et al., 2020; Shi et al., 2021). Despite the robustness, it is still important to ensure proper sampling of occurrence data and removal of highly correlated variables. Care was taken in this study to ensure the optimization of both occurrence and environmental data. The MaxEnt model was used to estimate the distribution of walnuts for two time periods (2041-2060, 2081-2100), under one shared socio-economic pathway (SSP 5-8.5).

The goal of this research is (i) to determine agricultural suitability of walnuts in California under current and future climate conditions; and (ii) to analyze the distribution characteristics of suitable areas for the two time periods.

Methods

2.1 Study Area

The area of focus for this study is the state of California. Walnut trees grow best in areas where there is deep, rich soil and they can receive full sun with long summers. Much of the land in California exhibits these characteristics. In 2019, the United States Department of Food and Agriculture's National Agricultural Statistics Service conducted a report estimating the total acreage of walnuts in California at 440,000 acres (USDA NSSS, 2020). Most of that area is within the Central Valley, a 450-mile valley and farming region in the center of California. Walnuts were first planted commercially in 1867 on California's central coast in Santa Barbara County, but by 1940 most commercial growing had transitioned north to the Central Valley where there were better growing areas, improved irrigation, and better pest control methods (California Walnut Board, 2022). Although most of the walnut cultivation occurs in the Central Valley, the model will consider the entire state when determining potential areas of suitability.

2.2 Data

Table 1. Data Layers used in the study.

Data Category	Data Name	Temporal Resolution	Spatial Resolution	Source
Environmental Variables	WorldClim Elevation Data	1970-2000	10' x 10'	https://worldclim.org/data/worldclim21.html
	California Land Use Data Based on CDL	2008 to 2020	30m x 30m	ttps://www.nass.usda.gov/Research_and_Science/Cropland/Release/
	Global Climate Model Data	1960-2100	10' x 10'	https://worldclim.org/data/cmip6/cmip6_clim10m.html
Established Walnut Crops	USDA NASS Cropland Data Layer	2008 to 2020	30m x 30m	https://www.nass.usda.gov/Research_and_Science/Cropland/Release/

Table 2. Climate models used in the study

Name of the Climate Model	Institution
CNRM-CM6-1	Centre National de Recherches Météorologiques (France)
CNRM-ESM2-1	Centre National de Recherches Météorologiques (France)
IPSL-CM6A-LR	Institut Pierre-Simon Laplace (France)
MRI-ESM2-0	Meteorological Research Institute (Japan)

2.1.1 Occurrence Data

Data on existing walnut crops was collected from the United States Department of Agriculture's National Agricultural Statistics Service Cropland Data Layer (USDA-NASS CDL), a geo- referenced raster and crop-specific land cover data layer. The CDL has been collected annually since 2008 and has a ground resolution of 30 meters. The CDL is produced using satellite imagery from the Landsat 8 OLI/TIRS sensor, the ISRO ResourceSat-2 LISS-3, and the ESA SENTINEL-2 sensors collected during the current growing season.

In order to ensure accurate data sampling, land use analysis was performed by comparing the data layers of each of the thirteen years. Each year's data layer was reclassified with a unique value so that the sum of all layers would yield corresponding unique sums for each cell. The sum of these values tells us how long a particular cell has been classified as a walnut crop in the CDL. Cells with the largest sum have consistently been classified as a walnut crop for all thirteen years, this results in a data sample of 302,901 points. Point data was then projected using the "GCS_WGS_1984" coordinate system as specified by SDMtoolbox, the ArcMap toolset used to prepare and run the MaxEnt model (Brown, 2021). To remove spatial autocorrelation and to prevent model over-fitting, points were then spatially rarefied at a distance of 5 kilometers. The final set of data points (n=259) was used as the SDM's input occurrence data.

To prevent the model from processing areas greatly outside the extent of the occurrence data, a set of background points is created to help distinguish the environmental variables that are suitable for walnuts. Background point selection was done via bias file with buffered minimum- convex polygons.

2.1.2 Environmental Data

Climate, topography, and land use were selected as factors affecting cultivation of walnuts in California. WorldClim version 2.1 historical climate data (1970-2000) was used to correlate with the current distribution of walnuts. WorldClim future climate data models were generated using the most recent iteration of climate projections from the Coupled Model Intercomparison Project (CMIP6). Four climate models were selected for this study (see Table 2), for two time periods (2041-2060 and 2081-2100), and under one shared socioeconomic pathway (SSP 5-8.5).

Of the 19 WorldClim bioclimatic variables 5 were selected (see Table 3) based on having a high percent contribution to the MaxEnt model and having low correlation between each other. Topographic and land use variables were included to ensure results were confined to areas with topography and land type appropriate for the cultivation of walnuts.

2.2 Model Calibration and Validation

A MaxEnt (version 3.4.4) model was generated using the occurrence data and environmental variables as inputs. Of the 259 occurrence points, 75% were used for training the model and the 25% for validation. K-fold cross-validation was used to evaluate the model's prediction accuracy.

Area under the curve (AUC) was used to evaluate the performance of the model. The AUC ranges from 0.5 to 1 and provides a measure of predictive accuracy. The Cloglog threshold for the 10-percentile training presence was then used to differentiate between suitable and unsuitable areas.

Table 3. Selected variables as input for the MaxEnt model.

Variables Category	Data Name	Variables	Content
Climatic Variable	WorldClim Bioclimatic Variables	BIO1	Annual Mean Temperature
		BIO4	Temperature Seasonality (standard deviation x100)
		BIO7	Temperature Annual Range (BIO5-BIO6)
		BIO10	Mean Temperature of Warmest Quarter
		BIO12	Annual Precipitation
Topographic Variable	WorldClim Elevation Data	Elev	Elevation
		Asp1	Aspect
		Slp1	Slope
Land Use Classification	Cropland Data Layer	Cal10	Agricultural Land Type

Results

The MaxEnt model for walnuts in California exhibited an average fitting level, with an AUC value of 0.780 (see Figure 1). A Cloglog threshold value of 0.346 was used to distinguish between suitable and unsuitable areas for walnut cultivation (see Figure 3). The SDM estimated an area of 38,427.6 square kilometers for the current potential distribution of suitable area, the majority of which is in central California. By mid-century (2041-2060) the area of suitability is estimated to decrease to 19,131.3 square kilometers, a 50.2% reduction. A significant portion of this reduction occurs in the southern part of the Central Valley in the San Joaquin Valley. For the late century time period (2081-2100), the area of suitability was estimated to be slightly smaller at 18,763.4 square kilometers, only an additional 1% reduction in area of the current potential distribution. The second reduction of area is less significant due to a gain in suitable area in certain areas, most notably

at the very southern end of the San Joaquin Valley near Bakersfield.

Discussion

        This study used a correlative species distribution model to map current and future potential distributions of walnut suitable growing areas. The SDM used a machine learning algorithm to estimate the potential distributions under mid to late century climate change scenarios. Results show a significant reduction in the area that is suitable for growing walnuts.

        The shifts in area between mid and late century time periods are marginal and would need further investigation to establish any sort of scientific significance. A large-scale study examining climate envelopes for North American trees, projected a northward shift of 8.2 ° latitude (~900 km) for the Black walnut tree, a close relative of the commercially grown walnut trees (Mckenney et al., 2007). This suggests that walnut trees will do better at higher latitudes than they have previously. In our study of California, the shift is not as dramatic, but the results do show a reduction in suitable areas mostly in the southern parts of the Central Valley while areas to the north continue to be suitable.

        Walnut trees in California can take up to 5 to 6 years to mature from a sapling and can live up to 200 years. Some of the more established orchards in the Central Valley have trees nearing 100 years old. The long-term time investment made by walnut growers will make them less likely to relocate to more suitable areas. Walnut trees that continue to grow outside of suitable areas will be exposed to more environmental stressors, especially temperature extremes in the form of late- spring frosts (Gauthier & Jacobs, 2011). Extreme weather patterns like freeze-thaw events and droughts are expected to increase in severity and frequency. These environmental stressors can have a knock-on effect that causes walnut trees to become more susceptible to diseases and pests. All these effects are cumulative and initial consequences may be subtle, such as with declining yields, but with time they can become severe, such as with outright crop failure.

Figure 1. Receiver Operating Characteristics (ROC) Curve
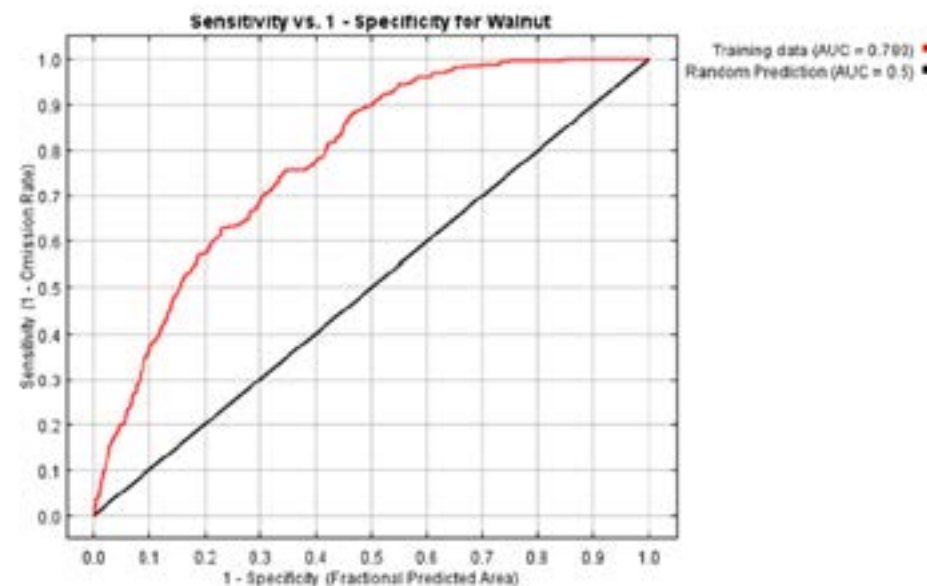
Table 5. MaxEnt Model Relative Contribution of Environmental Variables

Variable	Percent contribution	Permutation importance
elev	37.6	55.3
cal_10	27.5	10.9
slp_01	17.6	4.8
bio_12	12.5	20.3
bio_4	4.4	7.7
asp_01	0.4	0.2
bio_1	0	0.9

Figure 2. Potential distributions for walnuts from current to mid-century (green). Overlayed with actual walnut growing locations (red). Outlined by top 3 walnut growing counties by acreage.
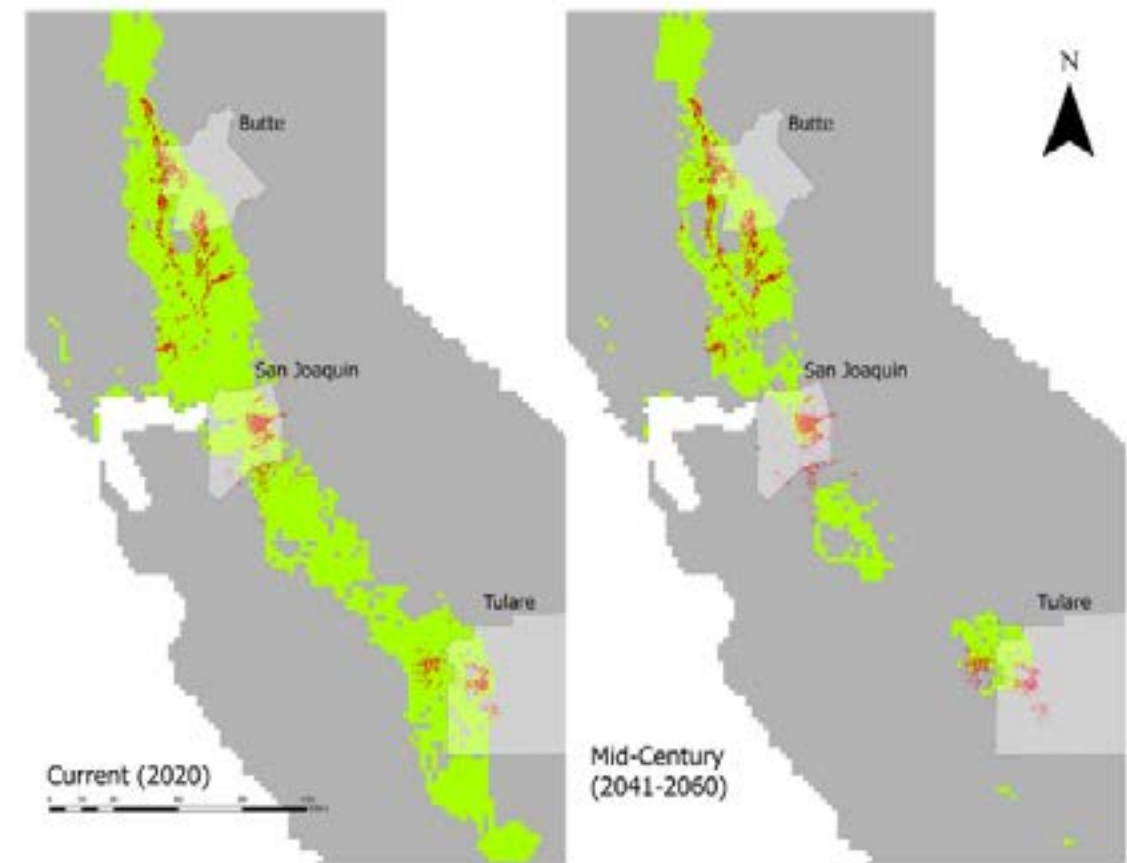
Figure 3. Current and Future Potential Distributions of Walnut Suitability

Conclusions

Climate change models indicate a drier and warmer California, which will have a strong effect on the cultivation of walnuts. Information provided by this research might help direct stakeholders on how to adapt to environmental changes. By knowing where land will become less suitable for walnuts, farmers can make informed decisions on how to restructure their land use. This research does not account for changes in agricultural technology and further work needs to be done to improve the predictive power of these models.

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Rogovoy Kirill   **Road Stress Detection Using Mask R-CNN**

Abstract

Road stress is an unpleasant phenomenon that drivers experience daily. If road stress is not detected and taken care of in its early stages, deterioration will continue, resulting in higher repair costs and presenting a hazard to driver safety. Due to a considerable amount of roadways in the U.S. providing uncomfortable and, in some cases, dangerous conditions for drivers, it is essential to perform regular maintenance of road stress occurring on roadways. However, the conventional manual recognition of road stress is inefficient because the process is labor and cost-intensive. On the other hand, Machine Learning provides a low-cost alternative to the human lead detection effort due to its ability to detect road stress faster among more locations than a human would cover within the same amount of time. In particular, the authors propose using Computer Vision, specifically a Mask Regional-Convolutional Neural Network (R-CNN) model, to detect road stress as it can effectively adapt to changing road stress examples. Roadway data collected from satellite images would be annotated and used to train the Mask R-CNN model, after which accurate detection of road stress elements in other areas would be made possible. As a result of the conducted research, it has been determined that the Mask R-CNN model utilized is an efficient tool for detecting road stress to an adequate level of accuracy. It is the authors' hope that Mask R-CNN would contribute to the effort of decreasing road maintenance costs by providing a cheaper and more reliable method of detecting road stress.

Introduction

Object detection is the ability to correctly identify obstacles on a road, and is a crucial ability of every driver on every road. Traditionally, object detection has always been done manually, but with the steady development of Computer Vision algorithms, it is now possible to accurately and precisely identify objects using Computer Vision. Object detection via Computer Vision has many benefits, such as improving the safety of transport system users on the road, quality control of road markings, and many more. For example, dangerous railroad crossings monitored by Computer Vision algorithms are able to provide safer methods for crossing railroad tracks (Fakhfakh et al., 2011). Another example - quality control of new road markings using Computer Vision, allows for an unbiased review of newly painted road markings, which in turn will allow for best budget spending and, of course, improved traffic safety for a community. (Lin et al., 2016). The broad spectrum of possible Computer Vision applications will become a valuable asset to society in improving the safety and quality of transportation systems.

To understand Computer Vision (CV) along with its methods and applications, it is important to consider Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and Neural Networks (NN). AI is an algorithm-driven adaptation of tasks by a machine, which develops an ability to make predictions and solve problems through the analysis of inputs and outputs. (Haenlein & Kaplan, 2019). ML is a subset of AI in which

computer algorithms use mathematical models to identify patterns to make decisions, given training from human-provided examples. CV is a subset of ML that works by analyzing visual images with the help of human input for training purposes and, as a result, makes decisions and predictions from other images based on the trained datasets. (Szeliski, 2022). CV has a broad spectrum of applications from medical, environmental, and transportation purposes, among many others. In the medical field, CV can be used to identify tumors in patients by analyzing X-ray images. In the environmental field, CV can be used to analyze crop health and assist farmers in agricultural processes. There is another method of CV, called Neural Networks, which are a series of CV algorithms modeled similar to that of a human brain to identify underlying patterns and relationships under different circumstances. One of the greatest advantages of Neural Networks is that they can work with a limited set of inputs to intake information and create predictions on future data based on the previously learned inputs.

CV applies NN to train algorithms and provides them with object recognition ability. NN uses linear regression and discriminant models to identify relationships between inputs and outputs, analyzing data based on the made relationships. (Sarle, 1994). NN has broad applications in many areas, such as the medical and transportation field. Next, are Convolutional Neural Networks (CNN) which operate by breaking images down into pixels. The pixels are then formed into a matrix (of varying dimensions), and a filter is applied to the said section. The dot product of the pixel matrix and filter is taken, with the value being stored in a convoluted feature. A convoluted feature identifies part of the object that the user is looking to detect. With more applications of unique filters, more features are identified. Thus, when the separate features are put together, object detection is made possible. (Liu, et al., 2015). A modification of CNN is R-CNN which stands for Region Convoluted Neural Network. This is a more efficient version of CNN, as it entails an algorithm that, instead of analyzing all regions of an image in a regular CNN process, selects 2000 regions that are deemed to be important. Upon completion of the CNN feature computations, the features are classified. But, it is important to note that the algorithm may inappropriately select the initial 2000 regions which may lead to an incorrect overall representation of the image. (Girshick, et al., 2017) An improvement upon R-CNN is Fast R-CNN. Fast R-CNN improves upon R-CNN by creating a convoluted feature map of the entire image at hand, and after finding the suggested region of interest, resizing it and moving it further down the layers. (Ghandi, 2018). Finally, Mask R-CNN builds upon Fast R-CNN in that it adds a layer of prediction of a Region of Interest (Mask) to the algorithm.

In the research project which we are currently working on, we are looking to identify instances of road stress on public roads. In road stress recognition, we are looking for our algorithm to be able to accurately decipher between the paved road and the cracking stress which occurs on it. This will allow for improved safety of vehicle operators on the road, as well as provide municipalities with information regarding the condition of their roads. The ability to recognize road stress will serve to reduce transportation-related injuries and make the maintenance of current transportation systems more effective.

Data Description

2.1 Data Collection

For the purposes of this research, data was collected using Google Earth as well as using drone surveys performed in 2021. When using Google Earth, the data was collected with a focus on keeping all variables constant. For example, all the road images were collected from the city of Pomona, California. Pomona was chosen as the primary area of study due to the abundance of road stress elements that were easily visible through satellite imaging. Multiple factors were considered when attempting to keep variables constant thought the collection of data; such as sunlight, elevation, positioning, type of pavement, and type of roadway. Due to that Google Earth relies on satellite imaging for data collection; the data may vary in brightness based on cloud location. In order to achieve the best training results for the model, images were selected based on the areas which did not have cloud interference with the satellite imaging, thus making the images brighter.

Figure 1 View of sun covered vs cloud shaded satellite image.

In Figure 1 above, an example of an area covered by clouds vs. an area not covered by clouds in Pomona, California is displayed. The next potential variable is the elevation of the satellite imaging. In order to keep a consistent process of data collection, the elevation of the screenshots of data was maintained at 180-220 feet above ground level. A similar concept was applied to the positioning of the areas of interest, in that the built-in Google Earth compass was always configured to point in the North direction, with the view pointing downat the ground at a 90-degree angle. Next, the type of pavement studied was asphalt. This was an important variable to keep consistent thought the study, as including concrete pavement in the study may have altered the results, due to that concrete pavement cracks differently and under different conditions rather than asphalt pavement.

In order to control the type of roadway used in imaging, freeways were excluded from the study entirely due to the wide range of speeds and vehicles which can be observed on freeways. Instead, residential and regional roads were used. Finally, it is important to note that pavement of relatively the same color was selected for the study with the intention of having consistency in terms of the color contrasts on the pavement. This was done in order to establish a more controlled set of variables, as a variety of uncontrolled variables will adversely affect the learning and consequently the output of the algorithm.

Next, for the analysis of drone image data, data was sourced from a drone survey done in (2021) by a CPP student. The data consists of images of residential areas, focusing on the roads. Data for the algorithm was sourced specifically from the road, and driveways were not considered for the research due to the driveway pavement's high variance of use and stress.

Imaging was done by DJI Phantom 4 Pro V-2.0 with the stock 20 Megapixel camera. Due to the closer distance of imaging, the quality of the photos collected by the drone was of much better quality than those by the satellite.

2.2 Data Annotation

Next, once enough data points were collected to adequately train a model, the data was annotated using the free VGG Annotator tool. See in Figure 2 below, an example of an annotated image in the VGG online annotation tool.
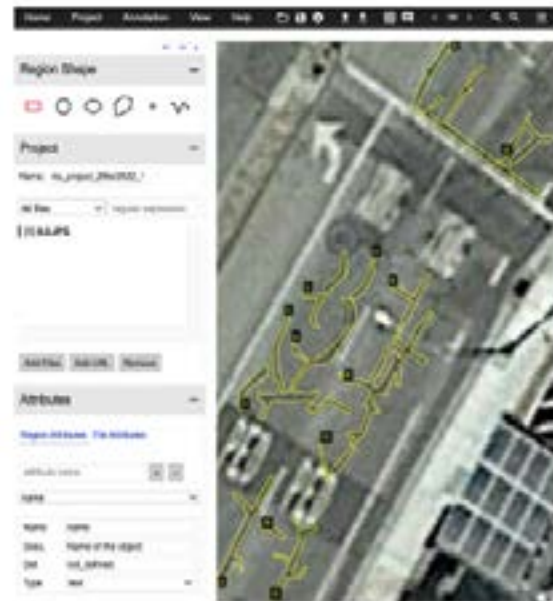
Figure 2 Annotation of Road Stress Using VGG Image Annotator

In order to achieve better results in the recognition of road stress elements, the data was annotated in sections from the overall large image. For example, an image as described in Figure 2 above was broken down into 4-5 smaller segments, in order to focus the algorithm's attention specifically on the details of the road stress.

Figure 3: Example of a split-off image used for model training.

The data was annotated in the following manner: in smaller segmentation of large images, as seen in Figure 3. On average, 10-20 annotations were made per small image. This tactic was used to allow the algorithm to focus on the made annotations, and avoid creating distractions with too many examples of the annotations. Figure 4 below displays an annotated satellite image from Google Earth, and Figure 5 displays an annotated drone image.
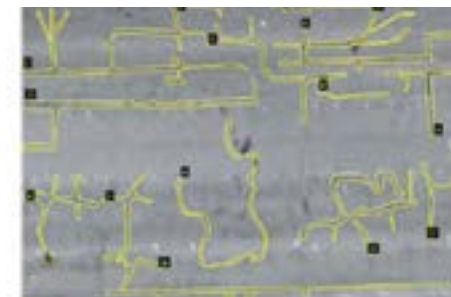
Figure 4 Example of an annotated Google Earth satellite image.
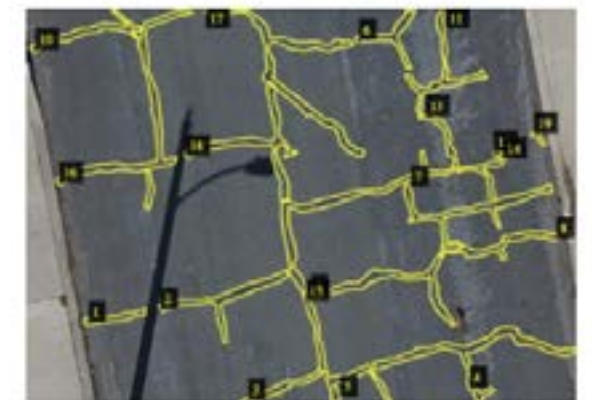
Figure 5 Example of an annotated drone image.

2.3 Data Statistics

In total, for the satellite image annotations, 8 large images were split into 27 smaller segmentations as discussed above. On average, around 11 instances of road stress were annotated in each of the smaller images. Regarding the drone images, four large images were selected for the research, and they were all split up into 12 smaller segmented images, averaging around 17 instances of annotated road stress in each image.

2.4 Data Processing

Once the images were annotated for roadsters in the VGG annotator, the annotations were stored in a .csv file. The individual CSV files were later combined, and a single CSV file along with the images was later uploaded to the algorithm for data processing. In total, for the satellite images, 294 annotations were made from 27 individually segmented images and combined into a single CSV file. For the drone images, 201 total annotations were made from 12 individually segmented images.

Methodology

3.1 Convolutional Neural Networks

Convolutional Neural Networks serve as a foundation, upon which the more advanced Mask R-CNN detection algorithm has been built. For the purposes of this research, Mask R-CNN served as the primary algorithm that was used.

3.1.1 Convolutional Layers

At the basis of Convolutional Neural Networks, are Convolutional layers - which serve as a foundation for the CNN algorithm. The process of convolution is performed by the above-mentioned convolutional layers. In this process, an image is split up into matrices consisting of pixels, with set height and width parameters. Once this has been accomplished, a weight (also known as a kernel or filter) is created to identify a parameter of an object which is to be recognized. The sum of products (also known as the dot product) between the weight and the pixel matrix is then taken, to yield a single value. The filter is then applied to other pixel matrices, including those that overlap. By the end of this operation, single values from all over the image are collected to yield a feature map - a two-dimensional array consisting of computed convolution values.

3.1.2 Pooling Layer

Once the feature map has been extracted, a pooling layer is applied to the feature map. Since feature maps take into account the location of an identified feature, the algorithm will associate the said feature with its location, which will in turn yield an inaccurate object recognition. The pooling layer prevents this, by analyzing the feature map and reporting whether an element is present in a certain location on the map. Acting similar to the filters described above, the pooling layers work across a feature map in a small (commonly a 2x2 pixel matrix) to identify the important components present in the

feature map. This is done in order to significantly downsize the feature map, and in turn, allow for faster computations within the algorithm. The existing average and maximum pooling layers work similarly. The average pooling layers calculate the average values of the convolutional layer outputs present in a region and, reporting this average value, significantly downsizes the image. The maximum oriented pooling layer identifies the maximum output values of the convolutional layer and reports them on a new map, thus also downsizing the original feature map.

3.1.3 Connected Layer

The fully connected layer flattens and creates a single vector from the repetitive interchange between the convolutional and pooling layers in CNN. A fully connected layer then applies more filters to the final output vector, to assemble a prediction of the object in an image.

3.2 Mask R-CNN

Built upon the basic principles of CNN, the Mask R-CNN algorithm used in this research outperforms its predecessor through advanced region selection and image segmentation. Mask R-CNN offers object detection at a rate comparable to that of humans in certain instances. Mask R-CNN builds upon Faster CNN - an advanced version of the previously discussed CNN algorithm. At the foundation of Mask R-CNN lie the Region of Interest Align layer (ROI -Align) as well as the prediction of segmentation masks for the selected ROI, and the usage of Feature Pyramid Networks (FPN). An important differentiating factor between Mask R-CNN and CNN is the addition of the ROI-Align layer to the recognition process and the discussed above segmentation masks. The initial feature extraction (convolutional layer) algorithm for Mask R-CNN is similar to that of regular CNN.

3.2.1 Feature Pyramid Network

In Mask R-CNN, the feature pyramid network structure is used to assist in the feature identification. FPN extracts different scale features and requires minimal processing while offering enhanced capabilities in small object detection and no drop in the accuracy of large object detection, all done with a rapid speed of inference. The deep and shallow features incorporated into the FPN backbone allow for better identification of large as well as small objects when compared to other algorithms, thus allowing for a wide range of differently sized objects to be identified.

3.2.2 Region Proposal Networks

Region Proposal Networks, a differentiating feature of Mask R-CNN from CNN, receive the earlier developed feature maps from the different levels of a FPN as input, and process them through the RPN's regression and classification models. First, the RPN generates anchor boxes, based on what a region of pixels has scored during the pooling operation. These anchor boxes are then classified to either be background or foreground and transformed into bounding boxes. This reduces the number of computations that an algorithm will need to perform, as the bounding boxes generate accurate regions of interest.

To further reduce computation time, the bounding boxes with coordinates tha t are not within image boundaries or those that have an Intersection over Union score of over 0.5 are expelled, and not further considered by the algorithm. As a result of these manipulations, approximately 2000 bounding boxes with considered regions of interest pass on to the next stage.

3.2.3 ROIAlign

The derived regions of interest do not perfectly lay upon the original boundary grids of a generated feature map. This misalignment adversely affects the process of the segmentation mask. So, in order to avoid this, bilinear interpolation is used in an operation called ROIAlign to calculate the specific x and y coordinates of the ROI. By performing the ROIAlign operation, the algorithm prevents the misplacement of boundary boxes in relation to the original boundary grids of a feature map and thus makes the segmentation mask more accurate.

A loss function is essential to neural networks, as it rates the performance of the algorithm, by assessing how the algorithm-predicted outcome compares to the expected result. The loss function which Mask R-CNN uses takes into account the loss due to classification as well as the localization and segmentation tasks. This equation is outlined below in Equation 1:

$$L = L_{cls} + L_{box} + L_{mask}$$

In the equation above, represents the loss from classification while represents the loss from the bounding box and the represents the mask loss, which is unique to Mask R-CNN. The loss can be calculated using Equation 2 below. It is important to note that the is only accounted for when the Intersection of Union value is higher than the threshold value of 0.5 used in this research.

$$L_{mask} = -\frac{1}{m \cdot m} \sum_{1 \le i,j \le m} \left[y_{ij} \log(\hat{y}_{ij}^k) + (1 - y_{ij}) \log(1 - \hat{y}_{ij}^k) \right]$$

3.3 Model Training

3.3.1 Hyper - Parameters Setup

The generated models were trained on a Nividia GeForce RTW 2080 Super graphics card with 8 GB memory, which loaded 1 image per batch for the training process. In order to best fit the dataset coming from satellite as well as drone imaging, certain parameters, which initially came from the MS-COCO dataset, have been adjusted. A summary of the crucial hyperparameters used in this research is outlined in Table 1 below:

Table 1: Hyper-parameter specifications

Hyper-parameter name	Detectron2's parameter name	Value
Warmup iteration	cfg.SOLVER.WARMUP_ITERS	2000
Base learning rate	cfg.SOLVER.BASE_LR	0.001
Training iteration	cfg.SOLVER.MAX_ITER	50,000
Checkpoint period	cfg.SOLVER.CHECKPOINT_PERIOD	1000
Number of classes	cfg.MODEL.ROI_HEADS.NUM_CLASSES	1
Batch size per image	cfg.MODEL.ROI_HEADS.BATCH_SIZE_PER_IMAGE	256
Anchor sizes	cfg.MODEL.ANCHOR_GENERATOR.SIZES	4,8,16
Anchor aspect ratio	cfg.MODEL.ANCHOR_GENERATOR.ASPECT_RATIOS	0.25,0.5,1.0
Input image's width	cfg.INPUT.MIN_SIZE_TRAIN, cfg.INPUT.MIN_SIZE_TEST	600 pixels
Input image's height	cfg.INPUT.MAX_SIZE_TRAIN, cfg.INPUT.MAX_SIZE_TEST	800 pixels

Once images from satellites as well as drones have been uploaded to the algorithm, the anchor point sizes were adjusted to the following values: 4, 8, 16 while the aspect ratio was defined as: 0.25, 0.5, 1. For the purposes of this research, the IoU value was set to 0.5, meaning that any value below 0.5 was classified as background and discarded, while any value above 0.5 was classified as foreground. Initially, a warm-up iteration of 2000 was used to train this model. The warm-up follows Equation 3 and allows for the adjustment of weights during the first nth iterations.

$$Rate = \frac{base\ learning\ rate}{n}$$

The models were trained on 50,000 iterations, with a saving checkpoint made every 1000 iterations.

3.3.2 Recall and Precision

Recall and Precision are tools used to assess the quality of object identification performed by an algorithm. The equations for precision (p) and recall (r) can be seen below in Equation 4 and Equation 5 below, respectively.

$$precision\ (p) = \frac{TP}{TP+FP}$$
$$recall\ (r) = \frac{TP}{TP+FN}$$

In both of the above equations, TP represents True Positives - that is instances of road stress that have been classified as such correctly. FP on the other hand represents False Positives, which are instances in which the algorithm identifies roadsters where it does not exist. In essence, precision is a metric of how accurately the model is able to recognize road stress, while recall is the model's ability to consistently, and correctly identify road stress.

Results

In most cases, the algorithm was able to successfully identify road stress instances. As expected by the authors, instances of road stress were better recognized in drone images rather than satellite images. This was the case due to a significantly better resolution of the images produced by the drone compared to the satellite.
4.1 Successful Recognition

Illustrated below, in Figure 6, is an example of successful road stress recognition in a satellite image by the algorithm.

Figure 6: Example of successful recognition of road stress by the algorithm from a drone image.

The differently colored bounding boxes represent an identified area in which road stress is contained. The percentage represents the model's confidence in that road stress is correctly recognized. This also stands true for Figure 7 below, which displays an example of successful road stress recognition in a drone image.

Figure 7: Example of successful recognition of road stress by the algorithm from a satellite image.

In this case, all present elements of road stress are correctly identified by the algorithm.

4.2 Problematic Instances

Although the majority of road stress present in satellite as well as drone images was correctly identified by the algorithm, some instances of false positives and false negatives were present in the output.

In Figure 8 below, an example of a false positive is displayed. In particular, the bounding box found in the southeast corner of the image, with an arrow pointing to it; identifies road stress with 97% confidence. This is an instance of false-positive recognition, as the algorithm recognized road stress which was not actually present there.

Figure 8: Example of false-positive recognition of road stress by the algorithm.

A more common issue - false-negative recognition was also present in certain instances of the algorithm outputs. Figure 9 below, provides an example of an instance where road stress is clearly present but is not recognized by the algorithm. It is important to note that although there is clear evidence of false-negative recognition, parts of road stress were recognized in this image. So, if manually checked over, the operator's attention would be brought to this image either way, as some part of the road stress was recognized.

Figure 9: Example of false-negative recognition of road stress by the algorithm.

Conclusion

In the future, the researchers plan on taking action to improve the model at hand and provide images of road stress in better resolution for training the algorithm in order to yield better results. This could be achieved through the further use of drone imaging instead of satellite imaging for road stress detection, and through the improvement of the drone's camera in order to take higher-resolution images. As can be seen from machine-recognized

examples of road stress, drones provide higher resolution and thus better images to be used for road stress recognition tasks. Also, with the rampant development of Computer Vision algorithms, it is possible that a faster and more efficient method of object detection will come along and replace the current Mask R-CNN algorithm used for this study. Researchers looking to improve upon this model may consider creating a real-time detection algorithm to recognize road stress in real-time. This would allow for an instantaneous recognition and report of identified road stress to a municipality, allowing it to rapidly address the issue or even warn drivers of upcoming obstacles on the road.

Acknowledgments

<div align="center">References</div>

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Salcedo
Juan

Narrating Pandemic Disparities: An Autoethnography

Abstract

The ongoing coronavirus pandemic has exposed social and economic inequalities in the United States. Contact within households is thought to be the leading cause for transmission of SARS-CoV-2, the virus which causes COVID-19. To curb transmission, Public Health Departments recommend families to socially distance and wear masks indoors, as well as sanitize the home regularly. Researchers have shown how communities of color are more likely to be economically disadvantaged and have more structural vulnerabilities. Our project is a collection of our own personal narratives, highlighting not only our experiences, but the community we reside in—Los Angeles County, California—throughout the pandemic to investigate how inequity lies within our communities. COVID-19 is currently being seen through the lens of numbers and statistics while disconnecting from the experience of the people during the pandemic. Our two autoethnographies will connect our experience of the pandemic to the experience of the numbers. In our current times, intimacy and affection are met with social distancing to reduce transmission, and our narratives put a more personal lens on the loss of intimacy and complete isolation from the world.

The COVID-19 pandemic has brought health inequality into high relief. When the effects of viral spread became apparent in the early months of January and February, the prevailing narrative was "we are in this together." However, as demographic information appeared detailing who was getting the virus, who was being hospitalized, and who was dying, it became clear that we were not, in fact, in this together but that suffering fell across well worn lines of racial and class inequality. Across the US, African Americans and Latinx Americans were 4.7 times more likely to contract the virus (CDC 2020). In California, specifically, Latinx people experienced the highest burden of disease cases, hospitalization, and mortality. Although Asian Americans in aggregate experienced less cases, several reports surfaced that the case fatality--or the likelihood of dying from the disease was highest among all groups (Yan et al 2020). At the same time, disaggregated data showed that some Asian communities suffered more than others. For example, Filipinos, especially Filipino nurses, comprised roughly 30% of the deaths during the pandemic (Kelliher 2020).

Our research team pondered these numbers, and realized that while numbers gave us some level of the pandemic's effect, the experiences of our communities during the pandemic is not reflected through data and statistics. We wanted to put human stories to the numbers. We were inspired by the Pandemic Journaling Project's opening line: "Usually, history is written only by the powerful. When the history of COVID-19 is written, let's make sure that doesn't happen." The goal of the project is to "make sure that ordinary people struggling through this pandemic have their voices heard, and their experiences remembered." We realized that our research team members were part of these groups that have been disproportionately affected by COVID-19, so we would like to add to their mission by arguing that not only should ordinary people's experiences be remembered, but also those who have been affected the most by COVID-19 health inequities.

In this piece, we present our own auto-ethnographic narratives about what it has been like to live through the pandemic. Ellis, Adams, and Bochner describe autoethnography as "An approach to research and writing that seeks to describe and systematically analyze personal experience in order to understand cultural experience. This approach challenges canonical ways of doing research and representing others and treats research as a political, socially-just and socially-conscious act" (Ellis, Adams & Bochner, 2011). After describing the contexts of our stories, we present two narratives from members of our research team. We begin with Juan's narrative, sharing his own experience of living and working through the pandemic, as a Meican-American, 1st generation College student in his 2nd year studying Anthropology with an emphasis in Archaeology and a minor in criminology . We finish off with Marian, in their third year majoring in Anthropology, where they discuss the grappling reality of a young adult in a pandemic—reflected by familial responsibilities and coping with loved ones away from home. Our stories provide a human face to the coronavirus pandemic as experienced in Southern California, as we touch on themes of isolation, family, and culture. In putting our stories on paper and reflecting on how they mirror our cultural moment, we demonstrate a commitment to remember the stories of our people.

Background

The World Health Organization (WHO) defines a pandemic as, "An epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people" (WHO) The COVID-19 Pandemic has affected the US in unimaginable ways and has affected other countries, and, in the United States alone, cases have reached over 32 million, while worldwide has reached over 154 million cases as of March 3rd, 2021. The pandemic also has affected the economy, unemployment has risen, hospitals and healthcare centers have been understaffed and overcrowded; these issues are visibly prominent in the US and around the world these issues affect everyone. With the creation of vaccines by Pfizer-BioNTech, Moderna, Johnson & Johnson's Janssen, and Astrazeneca, there is hope that the Pandemic will be minimalized and stopped. Last December, the vaccine rollout was met with turbulence and chaos, with states enforcing an "honor system" to ensure vaccination eligibility. This honor system was not properly implemented, and vaccine distribution became harder for lower income communities to secure (Shalby and Smith, 2021). This proves to be a challenge due to the limited vaccine available at the time in December of 2020, which only covered ▯ of the US population (Merelli, 2020). The inefficiency of the appointment process and the online registration led to a myriad of problems, mostly technical and server crashes, which led to many people unable to secure an appointment. Communities affected by this include: the elderly, low-income communities, minority groups—especially the Latinx population. A CDC study on "Hospitalization and Deaths by Race/Ethnicity," states that Black, Indigenous, and People of Color (PoCs) communities are most likely to report COVID cases and deaths—with Latinx communities topping the cases 2.0 times and 2.3 times more death— than their white counterpart (CDC). With this in mind, Asian Americans, Pacific Islanders, and Latinx/Hispanx communities are more likely to live in multigenerational households, increasing the probability of transmitting COVID through multiple people in an enclosed space.

During the start of Fall 2020 and Spring 2021 academic year, our research team got involved with this project on Narrating the Pandemic Living with COVID-19: How are households managing transmission within their homes? The team noticed different aspects that found negotiating the pandemic difficult with the most prominent being Low-income communities and Underrepresented Communities. With Low-income communities being an aspect; Low-income communities are more likely to lack financial resources that impact the way that they may manage the transmission of COVID-19. Low-income communities lack/have limited space, have more jobs/careers that require them to be essential workers such as those low wage jobs, i.e. Fast Food, Delivery/truck drivers, waitresses, ect. With underrepresented communities being an aspect; our research and literature findings have demonstrated the Asian & Pacific Islander communities (Marston, 2020) as well as the Latinx/Hispanix communities to be at high risk.

These ideas had Juan relate to my own personal experiences and related to his family situation. We hope with Juans' experience and stories will resonate with others

Being Desentized: Juans' Experience

I have been desensitized by the Pandemic. The Pandemic has affected us all and I'm curious to see how it has affected Low-Income Communities, and Minority Groups and put forward ideas of how to overcome the pandemic and how I can become sensitized again.

Last March when the quarantine was announced I was staying and living on Campus and then the world stopped. During these isolating times I have experienced emotions that confused me and at a certain point, I stopped feeling. I hear about the deaths of family members, deaths on the news, and deaths of people around me, yet I have become unphased and feel nothing for these losses. Losing my grandfather, my uncles, my friends, and people in my community was a tragedy, yet I personally felt no emotional attachments and felt nothing for their losses. I feel nothing. Well, that is not entirely correct, I feel desensitized. I am a Mexican-American from a community predominantly Latinx/Hispanic. I grew up in Southeast Los Angeles in a low-income community and city Maywood, CA, I was surrounded by family and friends who mainly have multiple generations in their households. I was privileged enough to be living on campus the 1st two weeks when the pandemic hit, I missed the toilet paper shortage and the chaos in the supermarkets. Many people lost their jobs and careers because of the pandemic yet I was lucky enough to be a Student Leader in housing and be compensated with free housing and a meal plan. After the 1st two weeks of the pandemic, I resigned from my position and returned back to my family and my community. My parents were adamant about me returning home. My reasoning for my resignation was to support my family as they were going through heartache and issues of anxiety and stress. They were frightened and overwhelmed with the development of the pandemic, so I went home. My return was calming, there was no chaos or toilet shortage, while on the surface many things seemed to be calming, underneath there were families losing their jobs, small business closing, and an increase of people living on the streets near the train tracks. As the pandemic continued I was sheltered in my room as I watched Instagram stories and posts of friends and families needing help paying for hospital bills, funeral arrangements, and panicking about what to do. Simultaneously while on Instagram it was being filled with hopelessness. I see my parents not working waiting to see if their jobs

will allow them to return and work during this time. Before the pandemic, my parents worked in demanding jobs. My mother works for UCLA at the dining halls and is a maintenance worker who works long hours in order to provide for her family. My father works in construction and specializes in Airport landing strips in which he installs lights, his job work is contracted for a limited time and then he is unemployed for a couple of months until he is contracted again to work. The pandemic affected them as most people in this country and had to stop working. I see my parents trying to see the struggle to afford to pay bills. Returning home was a change, as back on campus I was independent, had a spacious living quarters, and had tools and equipment for being successful at my academics. Due to our low-income status and the financial issues that followed, one of the biggest factors that affected me was that we could no longer afford Wifi/internet. The lack of Wifi affected my academics that spring semester term and after summer break I returned to living on campus with the position I previously had as a Student Leader in University Housing Services. Not a lot of people in my community were as lucky as I was to secure a job and housing, once again through social media, I observed the disparities that surround my communities and the challenges they faced during these troubling times.

Seeing my extended family and friends getting sick and even dying. I feel desensitized as I hear and see these tragedies and yet I felt nothing. Last December, during this time I returned back on campus, my mother was sick and tested positive for COVID-19, and once again I felt nothing. This is my mother, the person that gave me life, protected me, supported me, yet the idea of her being sick and potentially dying from this Virus did not phase me.

Am I horrible? Why am I desensitized? When did this start? What caused me to be desensitized? All these were questions that started having me reflect on how and why I am desensitized?

Unlocking and recalling my memories was a journey, I started looking back from the first time I saw a dead body. I was just a kid being inside my house like a normal day but then I heard wheels start to grind and screeching then came the shots "POP, POP, POP", it was deafening, it was nothing I heard in my video games nor in the movies. It was hollow yet deafening, when all was over I looked through the broken dirty curtains and looked outside to see my front door neighbors crying, screaming, and angry. When the police showed up I saw his dead body being covered up and moved. The person who was shot was a neighbor, whose families were fairly close and friendly. This was a person who I saw across the street and saw at neighborhood parties, dead on the ground lifeless with bullet holes and a person sobbing over their corpse. This experience scared me yet being told by my religious parents that he was in a better place was comforting. Through this journey of recollecting I recalled being around 8 or 10 looking at the news and reading a paper on the anniversary and aftermath of Hurricane Katrina and how people were lost. It was weird, people were lost but their bodies were there. How can someone be lost yet their bodies be there? The news was saying something about how hundreds or thousands were "unclaimed" or "lost", this is when I learned that not all people who die are identified or even "found". "POP, POP, POP" is all I can think about right now as I write this.

My first funeral happened when I was younger. It was the death of the family from my mother's side. I remember the open casket, drink Sierra Mist with my cousin and aunt, no one was crying from my close family from what I can recall yet looking at the dead body and hearing its stories and journey gave me comfort, this was a person who is found and laid to rest. I still don't know why I don't cry or feel emotional when confronting death. Everyone I talk to about death becomes emotional and sentimental yet I feel nothing. In high school biology when dissecting a fetal pig I felt no remorse or sadness yet my lab partners were full of strong emotions and disgust. In high school, my estranged cousin, who I shall refer to as A to preserve and honor my family's privacy. I never met A before his death besides when I was an infant. Hearing about the death of my family member and watching my mother and grandmother cry did not phase me or make me sad. I did not know A. This person had no connections with me besides blood and the connection the rest of my nuclear family had with him, yet seeing my mother and grandmother breaking down in the living room made me unphased and when my sisters heard the news they too shed tears. Yet, I felt nothing for A or my family sobbing about the death of a person who meant so much to them. During the funeral and the gatherings, I felt no emotions yet I felt disrespectful for not shedding tears, and not knowing this person justified my experience. On the other hand, when the death of my great grandmother who I knew and felt a connection. My Great Grandmother was someone I always visited every time I went to Mexico and stopped by her home, she offered me saltines and dulces. This generous and caring person is dead and I felt no emotion. Something I should mention is as a Mexican raised in a catholic household we hold rosaries for those who have passed away, I should note that I myself am not religious nor spiritual. A rosary is Mexican and Catholicism rites and traditions for those who have passed as prayers for the deceased occur for several nights. For my Great Grandmother when we had the rosary in my aunt's house all my family was in mourning, yet I felt nothing and pretended to feel something so as to not seem out of place.

Am I horrible? Why am I desensitized? When did this start? What caused me to be desensitized?

What I discovered through my journey is that I have been desensitized for the longest and I can recall why, yet I am not horrible at feeling emotions but when confronting death I do not feel emotions. Have I been desensitized by the Pandemic? Yes. The pandemic made me realize how much I have become desensitized yet it has shown me ways to overcome this obstacle and find a new mechanism for expressing my emotions.

COVID-19: Through the Lens - Marian's Experience

"Nakakapangamba (It's scary)," my mom said, phone by her ear, forehead wrinkled with worry—

It started with a flu, followed by a negative test result, then an abrupt call to 911. My uncle said he felt sick with the flu, as if his test result acted like an agimat (amulet) against the virus that killed over 500,000 Americans in a year. Due to his old age, we did not think about it too much; we grew accustomed to the slight wobble to his gait. We did not think that the last few moments we had with him were the tell-tale signs of his oxygen levels declining right under our nose.

It wasn't long until my uncle was admitted to the ICU, machines surrounding him, pumping air into his lungs with robotic force that at times, he felt closer to a cyborg than a human being.

A few days after, my dad, who lived with my uncle at the time, tested positive. Amidst the doom scrolling and toilet paper shortages, my family and I put down protocols we followed through the pandemic: Wearing masks outside at all times, changing from our outside clothes to our pang-bahay (home clothes), sanitizing mails, and refraining from seeing anyone outside our household. These are mandatory rules that CDC and Dr. Fauci have uttered a million times to the public, yet I realized that not everyone takes the same precautions as my family does. Living with my mom, who is immunocompromised, I am more vigilant in what I do and where I go, because one wrong step may end as the worst case scenario.

Perhaps hearing the phone call from my dad telling us he tested positive was scarier than death itself. It's a mix of anxiety, fear, and the thought of my dad contracting the virus despite the rigid protocols we, as a family, established and followed. Maybe this was the pain Atlas felt after being condemned to carry the heavens on his shoulders.

"Nakakatakot (It's scary)," I told myself, "I have to grow up again." I had to be strong for my mom, for my dad, for my brother.

I have heard stories of my colleagues battling through COVID at home, at work, and even back at their motherlands. I thought I understood the hardship they go through by listening to their stories and offering my shoulder to cry on, however, it is different once you, yourself, are in the same position. My eyesight went bleak—vision turned monochrome—as I think, what's going to happen to my dad? and other existential thoughts I wish I had control over.

A home away from home has become isolated–void of warmth and comfort–waving from the outside to say hello to my dad, confined by the walls of his room. The simple act of isolation became a way of caring, a way to keep the virus from spreading. We thought that his work will be the only thing that keeps him away from us, but the virus has also infected our family and our morale. Living away from my dad for the last two years due to his job has been anything but easy.

After a month of weekly hour-and-a-half drives to Temecula, my uncle passed away. His lungs gave up, his morale went down, and he let himself succumb to the virus.

He would have turned 60 this August.

In the Philippines, there is a pamahiin (superstition) that 60 is an important age. An age that decides whether you will live long or die now. Sixty is a year where the elderly back home would get sick, as if it is an initiation that only has two outcomes: live or die. My mother said that my uncle saved my dad, who turned 60 last February. Instead of mourning for the loss of my uncle, we decided to honor his sacrifice for not only helping my dad recover, but for protecting his wife from the virus as well.

A year has passed and I still hear the same stories on the news: COVID tolls rising, COVID deaths hit unprecedented records, countries struggling to contain the virus, new strains. A year has passed and the frequency of my relatives messaging us about who contracted COVID and what they need to recover steadily rises. At times, talking about COVID and the casualties it brought to our family felt taboo, especially with the Philippines experiencing the worst of the pandemic despite the vaccine rollouts we in America are facing. Whenever such a topic arises, the tension is palpable, despite only talking through a screen and a webcam; it feels as if everyone has a secret–perhaps to prevent each other from worrying–but there is no doubt that it is present.

Secrets manifested into coping mechanisms; hiding the darkest part of ourselves to not burden anyone around us. It's ironic, really. We hide secrets to keep each other safe, but hiding could only do so much before it backfires, especially through these trying times, when communication is of utmost importance.

My story is no different to the families who have lost a loved one from COVID. It is unfathomable how a nation that prided itself for its progressive actions suffered such a severe casualty. A year later, nothing has changed. Vaccines are rolling out, but the death toll is steadily rising, leaving a grim reminder of lives that could have been saved, families that could have been spared, and a government who could have put an end to this.

"Nakakabagabag, anak. Mag-ingat ng husto (It's scary, my child. Take care.)." were the words my mom would utter everytime I leave for work. Maybe this is the new normal, or at least, for a while.

Discussion

Throughout this project, some common themes we noticed from the experiences we shared are: feelings of isolation, issues plaguing our families, and the distinct cultural aspect of our communities. As the pandemic swept through the nation, the isolation we experienced from the endless quarantine and lockdowns has created a sense of disconnection among each other and the communities we live in. These families have suffered tremendous losses such as, untimely deaths of family members and unemployment. The perspectives we offer are greatly affected by our respective cultures, as Juan shares the perspective of Mexican-Ameircan culture and the issues that affect the culture, as well as Marian sharing the issues affecting Filipinos living in the United States and back home. Furthermore, COVID-19 has influenced many social issues we are currently facing such as the rise on Asian American hate and the ever-growing discrimination against Black Americans. Fortunately, we personally did not experience said discrimination, however hearing and seeing the news about them has shaped our communities to live in fear. While Juan focuses on the desensitization that arose during the pandemic due to his many experiences with death, Marian discusses their experience of losing a family member and the cultural implications surrounding the loss. While our experiences are not the same, we share the common link of family and community as well as issues that the pandemic has caused.

Conclusion

The COVID-19 pandemic has affected everyone around the globe and we have yet to see the full scope of the pandemic and the issues it has caused and will leave. The experience we shared of our own tragedies and experience is only the beginning. The disparities, the inequality, and the many issues of the pandemic are still ongoing and will leave a long lasting effect in the United States. The project we have presented is autoethnographic and filled with experience and knowledge collected as well as in depth research that is still progressing and changing everyday. With the underrepresented communities of the Latinx/Hispanx community and the Asian and Pasifc Islander community as well as with low-income communities the pandemic has brought out social issues and issues navigating the pandemic as we as the narrators have experienced during this time. These issues and the pandemic are difficult to negotiate and navigate but not impossible, we hope this work will help with the disparities and structural vulnerabilities will be addressed in the future and researched.

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Drivers of the adoption intention of 3D sumulted software in the apparel industry: Quantitative Approach

Abstract

3D simulated software for apparel helps garment firms and manufacturers throughout the globe to overcome productivity constraints, accelerate time to market, and improve sustainability standards by using 3D modeling and rendering. The incorporation of such digital software into the apparel industry has enabled technical and industrial progress in comparison to previous methods of garment, textile, and manufactured manufacturing production. However, not all apparel firms have been successful in implementing the software solution. Individuals' potential for adoption is influenced by the perceived depiction of difficulty or the stage at which software passes through a population. Following Technological Acceptance Model (TAM) and Innovation Diffusion Theory (IDT), this research aims to identify the obstacles that prevent or promote individuals from embracing 3D simulation software in the apparel industry, with the goal of making it simpler for users to adopt. An online survey was conducted to collect data. Those with experience with using 3D rendering software were recruited for this study. All measurements were adapted from the previous studies. The results of this study provide implications for practitioners who are interested in utilizing 3D simulated software as a part of their business or personal usage.

Introduction

Research Background

Only a few years ago that 3D design tools were widely regarded as belonging to industries such as automotive manufacturing or architectural illustration — in other words, the design of hard-surface creations (Goertzen, 2017). Three-dimensional fashion design technology is revolutionizing the way creatives in the apparel industry approach product development, pattern making, fittings, and other aspects of their work. Using 3D clothing design software, designers can streamline the design development process, saving both time and money while also reducing environmental impact (Lee & Park, 2017). Clothing companies can connect with audiences all over the world through 3D and augmented reality experiences, resulting in increased brand affinity.

It is possible to present ultrarealistic images of cloth drape and look when 3D technology is used, and this is changing the industry on a regular basis. Adidas, Hugo Boss, Louis Vuitton, and a slew of other companies are incorporating 3D design solutions into their design workflow (Kim & Forsythe, 2008). Without a doubt, ecommerce continues to be a growing area of interest for apparel designers. Utilizing 3D tools opens the door to the integration of augmented reality and immersive experiences into ecommerce, which can help to improve brand perception and customer relationships by increasing brand perception and improving customer relationships (Lyu, 2018).

A significant number of advantages can be gained by apparel companies by utilizing 3D design tools. One of the most significant advantages is that they contribute to increased overall production speed. Designers can virtually test numerous iterations of a garment, potentially shortening the time it takes for the product to reach the market by weeks or months (Choi, 2022). They can create and share photorealistic product visuals whenever they need them without having to wait for physical samples to arrive and working in 3D significantly reduces the costs associated with physical prototyping and manufacturing (Agrawal, Datta, 2019).

Despite the fact that the term "3D simulated software" does not refer to a specific piece of software, there is a wide variety of such software available on the market today. There are numerous companies that do this, including CLO 3D, Browzwear, TUKA Tech, Gerber, OPTITEX, Shima Seiki, and numerous others. As mention; the ability to generate patterns, check fit, and perform a variety of other tasks is provided by programs that allow users to create 3D avatars and 3D clothes, as well as programs that include a fabric library. Furthermore, sustainability is a concern for the apparel industry in the same way that it is for any other industry. A 3D process addresses this issue: designing garments in 3D significantly reduces the amount of waste generated by pattern cutting and fitting processes (Mckelvey, 2019). Working in 3D is, quite simply, the most ethical and environmentally friendly method of designing clothing. Make virtual fittings for your collection in 3D, design your collection in 3D, and even release your collection virtually (Villarreal, 2020).

The last point to mention is that 3D simulated software is changing the game for everyone involved in the apparel industry – including designers, manufacturers, retailers, stylists, and, of course, consumers. The ancient apparel industry is benefiting from cutting-edge technologies such as blockchain and virtual reality, which are allowing production and distribution methods to evolve at the same pace as consumers' changing tastes and fashion trends. A more streamlined industry will emerge as a result of the use of these software's, while simultaneously offering more options than has ever been available before.

Research Aim

3D simulation software has been steadily making its way onto the market, and it has demonstrated numerous benefits to the apparel production process. The majority of current study focused on how users' personalities and cultural backgrounds influence their willingness to adopt new digital applications. A number of previous studies have study has been conducted on how the specific features incorporated in the (apparel) digital software make it easier for users to adopt (Perry, 2017). In spite of this, very little previous studies have linked a lack of digital software adoption to factors such as insufficient management structures, low staff productivity, a lack of creativity, poor design and product development quality, and a scarcity of qualified specialists and training institutes (Bertola & Teunissen, 2018). The purpose of this study is to obtain user feedback and provide an assessment. Developing a conceptual understanding of the implications and drivers of the use of 3D simulation software. The following are the research questions for this study, which are derived from this information:

- What motivates potential users to use 3D simulation software is important to understand?
- So, what were the elements that stopped them from adopting or actually employing 3dimensional simulation software?

After providing an empirical assessment of the aforementioned concerns, the conclusions of this study go on to discuss a variety of different drivers of adoption that can be attributed to the use of 3D simulation software. They are concentrating on adopting from the perspectives of users, potential users, and non-users, with the goal of discovering the derivatives of adopting.

Literature Review

Technology Acceptance Model (TAM)

The technology acceptance model (TAM) created by Fred Davis established in 1989; was used as the theoretical framework to investigate the essential preconditions for the usage purchasing decision making. It was developed from the theory of reasoned action (TRA) (Ajzen & Fishbein,1980), which is a model that has been frequently employed in social psychology studies for many years. Users' readiness to embrace and apply new technology or media in the field of information system management was the focus of the TAM, which was established expressly for this purpose. Recently, TAM has been widely used to explain how customers use technology in the context of apparel purchasing, particularly in the context of online shopping (Cho & Wang, 2010).
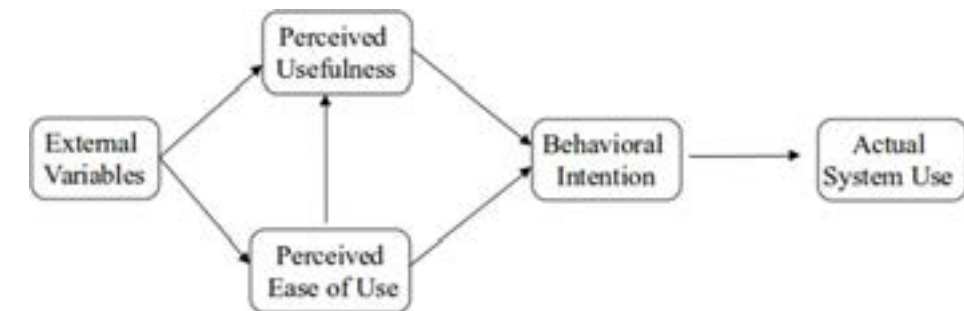
Figure One: Technology Acceptance Model (TAM)-(Fred Davis,1989) The origins of a person's attitudes in TRA are a person's behavioral beliefs and their judgment of the outcome. According to the findings, behavioral beliefs and result evaluation could not be used to effectively assess an individual's acceptance of a new system since they are heavily influenced by a variety of external circumstances (e.g.: the technical design characteristics of the system). Because of this, two variables from the self-efficacy viewpoint, perceived ease of use (PEOU) and perceived usefulness (PU), have been proposed as crucial determinants that impact users' attitudes and behavioral intentions (BI) (Davis, 1989). When it comes to technology, PEOU is defined as the degree to which persons perceive how easy it is to use the technology, while PU is defined as the degree to which individuals believe how helpful the technology would be (Davis, 1989). TAM asserts that both PEOU and PU have an impact on the formation of the use of technology, which, when combined with PU, results in persons having a greater BI to use the technology in question. Aside from that, it is anticipated that PEOU will have a favorable impact on individuals' opinions of the technology's utility (Davis,1989).

The adoption of new media for the purpose of acquiring new things has some parallels with the adoption of new technologies for decision-making purposes. New products, like new technologies, require PEOU and PU to the intended consumer, just as they do with new technologies today. TAM was successfully applied to choices at the organizational level. The applicability of TAM to non-technology contexts of outsourcing decisions was also evaluated and confirmed in their subsequent study, which is available online (Benamati and Rajkumar 2008). According to Benamati and Rajkumar, TAM was developed on the basis of the attitudes and intentions (TRA) model, which has been widely used in a wide range of consumer studies that depict the relationships between attitudes and intentions. As a result, it is possible to apply

TAM to consumers' label acceptance behavior in some situations.

Other research, which used the TAM as their theoretical underpinning, revealed that aesthetics and attitude were sometimes connected. Customers' positive attitudes of retail brands were influenced by aesthetics, as was the adoption of visual try-on technology (Kim & Forsythe, 2008). Product aesthetics was occasionally found to be closely related to the intention to engage in a particular behavior. Consumers, for example, prefer to use things that are visually appealing (Kim & Forsythe, 2008). Additionally, the appearance of a website has an impact on online purchase intention (Kang, 2014). With existing literature, a study published in the journal "Information Technology Adoption Across Time: Perceived usefulness, perceived ease of use, and user acceptance of information technology" (Davis, 1989). The report makes use of the TAM model to examine the pre- and post-adoption of Windows software, as well as the reasons for adoption given by users. As a result, the adoption behavior is examined in this study via the lens of perceived usefulness in 3D simulated software.

H1. Perceived usefulness of 3D simulated software will have a positive influence on attitudes towards the adoption of 3D simulated software.

Innovation Diffusion Theory (IDT)

IDT (Innovation Diffusion Theory) was developed by Everett M. Rogers after it was initially proposed by him in 1962. To understand how, why, and at what pace new ideas and technologies spread in a social system, innovation diffusion theory must first understand the social system in question (Rogers, 1983). Innovation Diffusion hypothesis provides a distinct approach when it comes to hypotheses that are constantly being revised. Rather than focusing on persuading individuals to change, it considers change to be primarily a process of evolution or "reinvention" of products and behaviors in order to better suit the needs of individuals and groups. The inventions themselves, rather than the people, are the ones that change in a dissemination of innovations (Les Robinson, 2009). The transfer of ideas from one society to another, or from a concentration or institution within a society to other sections, is referred to as the diffusion of ideas (Rogers, 1983). The following is a breakdown of the complete Theory of Innovation Diffusion, which goes as follows.

Innovators 2.5 percent: Quick to respond to and adjust to a change in circumstances. They not only contribute their time and energy, but they also share timely information to encourage others to follow their example. Innovators are more willing to take risks and are more willing to put new technology to the test firsthand. Moreover, they must be prepared to deal with concepts that are unprofitable or unsuccessful, as well as a certain amount of ambiguity over the innovation (Rogers, 1983). Early Adopters 13.5 percent: Individuals with strong opinions who are the first in their group to adopt and who are willing to examine their decisions in order to maintain their position. As a result, their judgment is critical not just in determining the fate of an innovation, but also in determining the rate at which it is adopted by other users of the technology (Rogers, 1983).

Early Majority 34 percent: Are rationalists who are fine with moderately progressive principles but will not act unless they can see actual benefits for themselves and their families. When it comes to implementing new technology or innovation, they often rely their decisions on the information offered by early adopters (Rogers, 1983). Late Majority 34 percent: When new technology is introduced, he first has reservations, but he gradually gives in to peer pressure (Rogers, 1983). Laggard's 16 percent: Those who make decisions primarily on what has occurred in the past rather than what will occur in the future. Will succumb to technological advancement or innovation because it is unavoidable (Rogers, 1983).

Figure Two: Innovation Diffusion Theory (IDT)- (Rogers, 1962)

According to Rogers, it is the process by which a technology spreads among a population of organizations. Diffusion of innovations refers to the transmission of ideas from one society to another, or from a focus or institution within a society to other sectors of that society, as opposed to the spread of ideas from one culture to another (Rogers, 1962). Based on his research into multiple areas of innovation, Rogers discovered that innovations with these five characteristics compatibility, trialability, complexity, observability, and relative advantage-are more likely to succeed than innovations without these characteristics.

Compatibility is defined as the degree to which an innovation is perceived to be compatible with the user's current values, previous experiences, and requirements. New innovations emerge from among existing ones, drawing on the experiences potential adopters have had with past innovations as well as their own personal values and beliefs, to form a new category of innovation (Winter, 2003). In other cases, inventions are considered as part of an even bigger set of innovations, which is referred to as a technological cluster, and are evaluated by potential adopters in the context of the group rather than on their own merits.

Trialability determines the rate of adoption is the simplicity with which a product or service may be tested and tried out. The greater the degree of trialability, the larger the pace of diffusion would be expected to be. This is due to the fact that prospects get the opportunity to experience the product/service, evaluate it, and ultimately decide whether or not to purchase it (Rogers, 1962). Customers were able to try out the unique item, evaluate it, and then make a decision on whether or not to purchase it by accepting or rejecting the offer. Trials that lead to a purchase can be facilitated by the use of guarantee and warranty programs. Such trials assist a product or service in becoming more widely available.

The level of complexity involved in the acquisition and use of a product has an impact on the diffusion process. When something is simple to comprehend, purchase, and utilize, it is more likely to be widely adopted as a revolutionary product (Rogers, 1962). The more the ease with which a product may be understood and used, the greater the likelihood that it will be accepted rapidly, and vice versa. When it comes to technological complexity, it is important to note that it works as a barrier to spread. People are reluctant to adopt new items because they are concerned about the complexity of the buying and use process (Rogers, 1962). This is something those high-tech industries are well aware of.

Observability is the ease with which a product can be observed that is referred. The degree to which the benefits of a product or service can be viewed, imagined, and felt by a potential user is referred to as observability in an innovative product or service. The greater the degree of observability, the more likely it is that the innovative service will be accepted by the prospects' needs and desires (Wonglimpiyarat & Yuberk, 2005). It is more difficult to diffuse new product offerings that are intangible, lack social visibility, and have benefits that are difficult to observe due to a long-time lag; than it is for new product offerings that are tangible, lack social visibility, and whose benefits accumulate over a long period of time (Rogers, 1962).

The relative advantage of the innovative product/service offering over previously available products/services accelerates the rate of adoption of the innovative product/service offering by the target market. The relative advantage of a new product or service is determined by the degree to which buyers believe it to be superior to similar existing offerings (Rogers, 1964). Product or services' differentiation indicates it's superior to existing alternatives and hence has greater "value" in comparison to those alternatives. The greater the degree of radical change, as well as the greater the relative advantage, the faster the dissemination would occur (Winter, 2003). The relative advantage may be due to the fact that it is a modified product with improved features, attributes, benefits, form, and so on. Additionally, it is offered at a lower price, better deals, discounts, terms of payment, warranty, and exchange (Wani, 2015). Lastly, that it is more readily available in terms of availability physical store format, virtual electronic format, or that it has better communication capabilities (Wani, 2015).

A number of assumptions arising from the theory have been empirically tested, and the results are encouraging. As a result, test the hypothesized relationship between the characteristics of an innovation and the rate at which it is adopted. Continued use of the paper " Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and PostAdoption Beliefs" (Karahanna, Straub, & Chervany, 1999).

The article discusses the subjective norms of Windows adoption as well as the influenced behavior norms of Windows adoption innovation and adoption. A combination of the work of Karahanna, Straub, and Chervany as well as the IDT model. Resulted in the adoption behavior is examined in this study via the lens of perceived complexity, relative advantage, and compatibility.

Sustainability

Sustainability is a recurring topic of discussion and challenges businesses to consider what they can do to improve the quality of the planet's environment. The apparel industry is no exception, as it is the second-largest polluter on the planet after the oil industry (Waage, 2007). In the apparel industry, there has been a consistent stream of trials and efforts to make fashion more environmentally friendly. Perhaps 3D simulated software has the potential to bridge the gap between better sustainability practices in the apparel manufacturing industry. With less sample production and the creation of 3D simulated garments, the garment industry will be able to reduce its waste, which is important considering that the majority of samples are discarded and go through ridgerest other samples until they achieve the antique fit.

Positive factors contribute to the overall worthiness of 3D simulated computer software. Either through the process of catching mistakes in 3D and making modifications while they are still fresh, in order to ensure that mass production runs smoothly (Waage, 2007). In addition to the perceptual intention of using 3D simulated software's and the positive ethical factors of sustainability when using 3D, there are other considerations to consider. Despite the fact that 3D simulated software has been available for quite some time, adoption is still lacking. As a result, this paper concentrates its research on discovering the essence of understanding professional users versus non-professional users; specifically, the drivers and barriers to adoption. As a result, sustainability is examined in this study.

H5. Adoption of 3D simulated software may be from the industry leaning towards sustainability.
Method

Study design

This study used quantitative method. Quantitative research aims to gain a comprehensive understanding of behavior and other events in a wide range of situations and populations (Goertzen, 2017). One advantage of using quantitative methods is the speed and efficiency; when dealing with large sample volumes, data computing equipment allows for quick processing and analysis of the results. The instruments that are used to collect and quantify quantitative data include surveys, polls, statistical analysis software, and other similar tools and techniques (Goertzen, 2017).

Although quantitative research is not limited to a single method, it is divided into the following categories. Descriptive research is used to gain a better understanding of a phenomenon, a situation, or a group of individuals. This approach attempts to identify characteristics, categories, and trends. In descriptive research, observations and surveys

are the most frequently used methods of gathering information (Creswell, 1994). The direction (which can be positive or negative, or close to zero) and/or strength of the relationship discovered between two variables offers how the two variables are related to each other (Creswell, 1994).

Second is experimental research; concerned with determining the effect of one or more independent variables on one or more dependent variables through the application of the scientific method. This is accomplished by manipulating the independent variable in order to investigate the effects of the independent variable on the dependent variable (Creswell, 1994). This experimental research design entails carrying out a series of procedures in order to test the hypothesis of the research study. Subjects in experimental research are assigned to groups based on a random selection process (Goertzen, 2017). Given that this study aims to understand what individual characteristics affect their intention to adopt 3D simulated software, a descriptive study design was used to test the hypotheses.

Measurements

All of the measurements were adapted from previously published studies. The values for each independent variable were derived from Davis (1989), Karahanna, Straub, and Chervany (1999), and Waage (2007), with the appropriate modifications to 3D simulated software. First, the concept of perceived usefulness was borrowed from Davis (1989). Among the statements were "If I were to use 3D simulated software, it would allow me to complete my tasks more quickly," and It would improve the quality of my work, it would increase my effectiveness on the job, and it would make my job easier if I were to use 3D simulated software. "If I were to use

3D simulated software, it would improve the quality of my work." Nine items from Karahanna, Straub, and Chervany were used to measure perceived complexity, compatibility, and relative advantage. Three items for each variable were used for each variable (1999). Questions such as "How confident are you that 3D simulated software will perform well," "How confident are you that 3D simulated software will work satisfactorily," and "How confident are you that 3D simulated software will work well in your daily life" are used to measure perceived complexity. For example, "If I were to adopt 3D simulated software, it would give me a high status in an organization or the apparel industry," "If I were to adopt 3D simulated software, I would have more prestige in an organization or the apparel industry than people who have not," and "Knowing 3D simulated software is a status symbol in my organization" are examples of questions relating to relative advantage. The following are examples of compatibility-related questions: "If I were to use 3D simulated software, it would be compatible with the vast majority of my work," "If I were to adopt 3D simulated software, it would be a good fit for my work style," and "If I were to adopt 3D simulated software, it would be a good fit for the way I like to work."

Finally, three items from Wage were adopted for protracted suitability (2007). As for the questions in the questionnaire, they were all taken from various topics and tailored to be relevant for 3D simulation software used in the apparel industry. These are the questions: "If I were to adopt 3D simulated software, would it be the most sustainable solution," "If I were to adopt 3D simulated software, would it be the most sustainable solution ," "If I were to

adopt 3D simulated software, would it be the most sustainable solution," and "If I were to use 3D simulated software, I would be able to reduce fabric waste," and "Adoption of 3D simulated software aids the implication of sustainability in various parts of the apparel industry."

A seven-point Likert scale was used to evaluate each item, with 1 representing strong disagreement and 7 representing strong agreement. On a seven-point Likert scale ranging from "1" to "7," where "1" indicates strong disagreement and "7" indicates strong agreement.

Sample and Data Collection

Qualtrics was used to create an online survey for the project. Participants in the study were drawn from the apparel industry and had prior experience working with 3D simulated software. Only those with prior experience with 3D simulated software were invited to participate because they already possess the fundamentals of either how to use the software or the outcomes of its use without having actually used the software. Participants were recruited through a variety of channels, including LinkedIn, email, and Instagram, among others. In the following steps, after participants agreed to participate and submitted a consent form, they were asked to answer a series of questions, which included whether they intended to continue using 3D simulated software: Perceived Usefulness, Perceived Compatibility, Compatibility with Other Software, Sustainability. Finally, questions about demographics were asked.

Results

Preliminary Analysis

There was a total of 48 respondents in total, but only 23 pieces of usable data were collected for this study. According to the responses to the questionnaires, 23 percent of the responses came from men, 76 percent came from women, and 1 percent did not want to be identified. A substantial majority of the respondents were below 45 years of age but over 25 (66.4%). The statistical analysis was carried out with the help of SPSS 27.0. In the first instance, factor analysis and Cronbach's alpha were performed, and the results were found to be satisfactory, with Cronbach's alpha values greater than 0.85 for all measures, thereby confirming the validity and reliability of the measurements.

Hypothesis testing

For the purpose of predicting people's intentions regarding the adoption of 3D technology, a multiple regression was carried out using factors such as perceived usefulness, perceived complexity, compatibility, relative advantage, and sustainability. These variables were able to predict with a statistically significant level of accuracy the intention to adopt 3D ($F_{(3, 287)} = 161.52$, $p < 0.001$, $R^2 = 0.63$). In particular, perceived usefulness H1 ($\beta = 0.822$, $p = 0.05$) marginally significantly predicted 3D adoption intention. This was in contrast to perceived complexity H2 ($\beta = 0.29$, $p > 0.05$), compatibility H3 ($\beta = -.20$, $p > 0.05$), relative advantage H4 ($\beta = 0.05$, $p > 0.05$), and sustainability H5 ($\beta = 0.16$, $p > 0.05$). As a result, only the first hypothesis, H1 perceived usefulness, was accepted, while

the other three, H2 perceived complexity, H3 compatibility, H4 relative advantage, and H5 sustainability--were not.

Conclusion

Discussion

The purpose of this study was to better understand the factors that influence people's decisions to continue using 3D simulated software. The findings revealed that perceived usefulness was found to be associated with the intention to use 3D simulation software in a statistically significant positive way. Other characteristics and the desire to use 3D simulation software, on the other hand, were found to have no statistically significant relationship with one another. However, while it is possible that none of these factors had a significant impact on individuals' willingness to use 3D simulated software, it is also possible that the small sample size had an impact on the level of significance. Increasing the sample size to include a larger number of participants may allow for the validity of the findings to be established.

Implications

A significant factor influencing adoption has been identified as perceived usefulness, and practitioners should emphasize how 3D simulation software can be beneficial to their work environments. An option that should be considered is the organization of various professional development seminars to highlight the usefulness or benefits of 3D simulated software and to encourage users to make use of 3D simulated software, which is highly recommended.

Limitations and Future Research

It has already been stated that the findings of the study may have been skewed as a result of the small sample size that was used. An increase in the sample size could aid in identifying the factors that are preventing people from embracing 3D technology in their lives. Furthermore, because the participants in this study were drawn from the industry, the study's generalizability may be limited. To gain a better understanding of why different users choose to use 3D simulation software in the first place, future research may concentrate on the educational context. For those who do not have prior experience with 3D simulated software, other considerations may be more important. Aside from the factors investigated in this study, there are other factors that could influence people's intention to adopt or use 3D simulated software. In order to satisfy the involvement of apparel professionals with no 3D knowledge, companies that develop 3D software ought to organize learning seminars and conduct additional marketing on the subject of the advantages of utilizing 3D in the design process (e.g., patternmaking, fabric library, sewing, grading, and so forth).

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Autonomous Flight of High-Endurance UAVs

ABSTRACT

We are developing a network of fully autonomous drones to monitor powerlines while being able to recharge their batteries via magnetic inductance from power transmission lines. Powerline work is difficult and dangerous, and we are researching a way to make a drone that will provide a safe and easier option for monitoring and fixing powerlines. Autonomous flight is the act of a drone flying while being unmanned by a pilot. Our team, BANSHEE UAV, is an interdisciplinary research group of the Aerospace, Electrical/Computer Engineering, and Mechanical departments. Our Electrical/Computer Engineering Communications team is designing a 2-axis camera gimbal to monitor powerlines and implementing a computer vision algorithm for object avoidance and object detection. In the future, we plan to implement an IoT, Internet of Things, approach to connect the drones one to another and have the wings of our aircraft recharge their batteries through magnetic induction. With a 4G LTE Mobile Tower, we can have a network of fully autonomous drones communicating with a GCS, Ground Control Station, to replace the batteries and an MES, Mobile Edge Station, to offload the processing done on the drone.

MAIN OBJECTIVES

Our main objective is to design and assemble a custom low-profile, lightweight 2-axis camera gimbal and implement a computer vision algorithm for object avoidance and object detection. Our 2-axis camera gimbal will be attached to the underside of the battery tray of the drone and will use object avoidance and object detection algorithms to detect and monitor powerlines.

LITERATURE REVIEW

We want to develop a network of fully autonomous drones to monitor power lines and be able to automatically recharge their batteries via magnetic induction. Powerline work is a dangerous job where a team of people is on a helicopter monitoring a powerline high above the ground or is very time-consuming working on the ground manually. The drones we want to develop will make powerline work safer and less time-consuming. Drones are unmanned aerial vehicles (UAVs), controlled using a remote-control device to control their flight and have no human pilot to operate them. Drones in the past have been used as spy surveillance and weapons of war. Today, drones play a big role in taking photos from afar or delivering packages to customers for commercial use.

There are various software and hardware we use to operate the drone. One of the hardware pieces on our drone is the Raspberry Pi 3B+. This hardware is an onboard companion computer with a Linux operating system for programming in Python that communicates with the flight controller via the UART port. This device's goal is to send flight commands to the flight controller to move the drone. Also, the Raspberry Pi has a 4G LTE USB transceiver to communicate to radio-based networks. The other hardware piece on the drone is the Pixhawk 4 mini. The Pixhawk 4 mini is an onboard flight controller that communicates with the Raspberry Pi 3B+ to control many aspects of the UAV. These aspects are controlling drone levels, receiving GPS input, manual flight control, controlling the drone's DC motors, and receiving and sending data over telemetry.

The software we mainly use for autonomous flight is DroneKit. DroneKit is an open-source Python API based on the c-based library called MAVLink. MAVLink is an open-source lightweight message protocol that communicates with the drone and its components [2]. MAVLink allows the Raspberry Pi to communicate with the Pixhawk 4 mini. Also, DronkKit allows for high-level communication between the GPS and the drone through MAVProxy. MAVProxy is a c-based GCS development kit based on the MAVLink protocol. The DroneKit's best features are simplifying software initialization and allowing easy communication with the GCS, Ground Control Station.

METHODS

Methods for the wiring and the design of the 2-axis camera gimbal were done by the hardware team. Methods for implementing object avoidance and object detection were done by the software team. When designing the gimbal, we first had to wire the Raspberry Pi 3B+ and the Pixhawk 4 mini together before we could attach the servo motors of the 2-axis gimbal to the Raspberry Pi. To do this, we used PSpice and Microsoft Paint 3D to create a schematic of how the Raspberry Pi and the Pixhawk 4 mini would be wired in real life. Figure 1 shows a schematic of a pin layout of the wires connecting to their designated pins. Figure 2 shows which ports on the Raspberry Pi and the Pixhawk 4 Mini are physically wired.

After wiring the Raspberry Pi and the Pixhawk 4 Mini, we made the schematics to attach the servo motors of the 2-axis camera gimbal to the Raspberry Pi. As shown in figure 3, the pin layout shows where the servo motor ports would be connected on the Raspberry Pi. Figure 4 shows where the servo motor wires are physically connected to on the board.
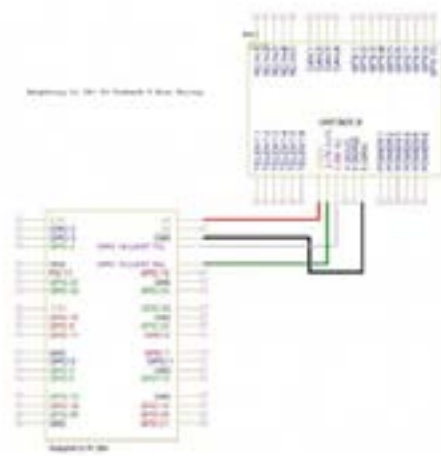
FIGURE 1

PSPICE HARDWARE SCHEMATIC FOR RASPBERRY PI 3B+ TO PIXHAWK 4 MINI

FIGURE 2

MICROSOFT 3D PAINT SCHEMATIC FOR RASPBERRY PI 3B+ TO PIXHAWK 4 MINI [1]

FIGURE 3

PSPICE HARDWARE SCHEMATIC FOR RASPBERRY PI 3B+ TO THE 2-AXIS GIMBAL SERVO MOTORS
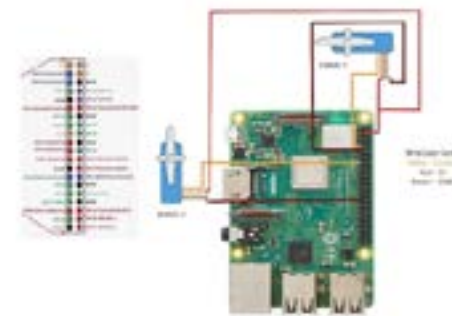
FIGURE 4

MICROSOFT 3D PAINT SCHEMATIC FOR RASPBERRY PI 3B+ TO THE 2-AXIS GIMBAL SERVO MOTORS [1]

After we built the schematics for the gimbal servo motors to the Raspberry Pi, we designed the 2-axis camera gimbal on software called Autodesk Fusion 360. This software allows us to build a 3D model of our 2-axis camera gimbal from scratch. Figure 5 shows the 2-axis camera gimbal designed in Autodesk Fusion 360.
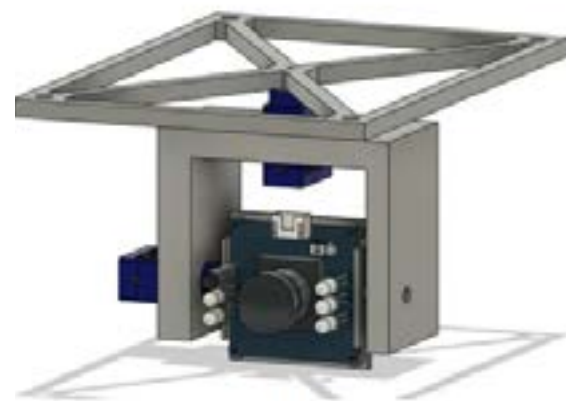
FIGURE 5

CUSTOM LOW-PROFILE, LIGHTWEIGHT 2-AXIS GIMBAL.

Our methods for the computer vision algorithm for object avoidance and object detection are to use YOLOv4 and OpenCV. YOLOv4 is an image recognition algorithm that captures a live video feed from the 2-axis camera gimbal and sends the video feed to the Ground Control Station. With YOLOv4, we can estimate the distance of an object from previous frames captured from the camera. This gives us an ideal distance vector of the object in the x, y, and z-direction and gives us the best option for avoiding objects. OpenCV is an object detection program that utilizes an adaptive threshold in finding the longest contour or object in a frame. This algorithm highlights and outlines a contour or an object to determine whether it is the correct contour or not.

RESULTS

The results of our 2-axis camera gimbal for our drone are shown in Figure 6. We were able to 3D print our 2-axis camera gimbal and test it on a Raspberry Pi 3B+ for functioning. We made our gimbal because the drone is lightweight and sensitive to weight. The more weight is on the drone, the more power consumption is used to keep the drone in the air. This gimbal has 90 degrees of freedom in the yaw direction from the top motor and 270 degrees of freedom in the pitch's direction from the side motor. This gives the camera a view of 270 degrees in the yaw direction and 300 degrees in the pitch direction. The design of this gimbal allows our drone's camera to face forward to detect objects, look directly down to land at a ground control station and look around while hovering in the air. We have not been able to test our gimbal on our drone due to time constraints; however, from our tests, our 2-axis camera gimbal can move in the horizontal and vertical directions and function on the Raspberry Pi.
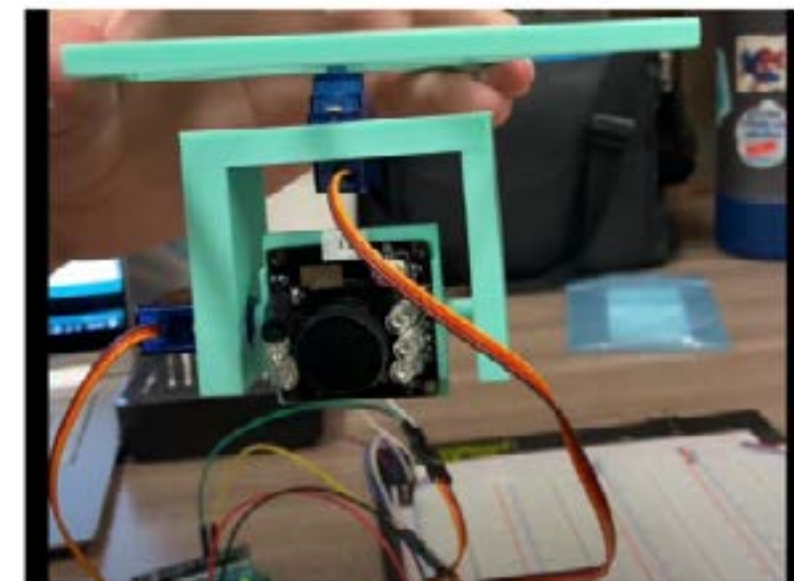
FIGURE 6

CUSTOM LOW-PROFILE, LIGHTWEIGHT 2-AXIS GIMBAL 3D PRINTED

Our object detection algorithm can detect a wire in a curly and straight form as shown in Figures 7 and 8. Thanks to the Open CV object detection algorithm, we can detect a wire and distinguish what we are looking for when monitoring powerlines. The algorithm works by finding the longest length and largest area to detect the wire. Figure 7 shows a curvy wire and Figure 8 shows a straight one. The wire shape only matters when it is not the longest length and not in the largest area of the frame. This means that for the wire to be detected, it must be the longest and largest object in the frame for our computer vision algorithm to detect it. The longest and largest object in the frame will be highlighted in green as shown in Figures 7 and 8. We haven't tested this algorithm on our drone and there are still some revisions it needs to go through before it becomes what we desire. The object avoidance computer algorithm is still in the research stages and there haven't been any results in using YOLOv4 other than a literature review.

FIGURE 7

WIRE DETECTION ALGORITHM (CURVY WIRE)

FIGURE 8

WIRE DETECTION ALGORITHM (STRAIGHT WIRE)

DISCUSSION

Throughout the school year, we have developed and implemented our 2-axis gimbal and have started developing an object detection algorithm to detect wires. Having a custom camera gimbal 3D printed gives us the freedom to determine the weight of the drone and the 2-axis gimbals movement. Our object detection program, OpenCV, will help detect powerlines by finding powerline wires. Both implementations need to be tested on the drone to help build a better gimbal and a more accurate object detection algorithm. The gimbal in the future will go through many revisions in terms of weight and functionality. The object avoidance algorithm will be implemented with our object detection program to help avoid an object and accurately detect powerlines.

In the future of our project, we plan to implement an on-base induction coil to the wing of our aircraft to recharge its batteries and monitor voltage drops in the powerline through magnetic induction. Also, we want a network of drones to become autonomous in-flight where a drone operator would not be required. To achieve this, we plan to have our network of drones communicate to the ground control station and a mobile edge station through a 4G LTE network. This 4G LTE connection will allow for our drone to transfer any video feed it captures to the mobile edge station to offload the processing on the drone and

send the feed to the ground control station to keep our drone autonomously in-flight.

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Schwarz   **Venture Capital Investing Outcomes, Effectual Logic, and Actively**
Tovin   **Open-minded Thinking**

INTRODUCTION

Venture capital investment is a high stakes process, yet highly uncertain process. If investors cannot know in advance what investments will pan out, then how do they decide? For several decades researchers have worked to understand what approaches to uncertainty are more successful than others. Research on decision making in general would highlight the importance of looking at whether decisions are made more analytically or more heuristically. Decision errors are often thought to result from a failure to analytically correct for intuitively appealing, but incorrect initial impulses (Stanovich & West, 2000). For example, more analytical thinkers (meaning, people who tend to weigh evidence from multiple perspectives and eschew intuitive appeal) make more well-thought-out, less impulsive decisions (Cools & Van den Broeck, 2007), are less superstitious (Sadler-Smith, 2011), and prefer systematic evidence to evidence rooted in personal experience (Stein, Swan & Sarraf, 2020).

A straightforward extension of this body of research would suggest that prioritizing even-handed assessments of evidence over intuitive feelings would lead to investor success. Some research suggests this. For example, investors vary in how loss averse they are, meaning that some investors react stronger to losses and risks than to making a gain of similar or more value. Some investors hold losers for too long and sell winners too early (Bodnaruk & Simonov, 2014). Some loss averse investors will even pay a premium for securities with a lower downside risk. More generally, overconfidence is common among investors, especially when they feel they are using their "gut" to make decisions (Zacharakis &, Shepherd, 2001). Investors can be outperformed by actuarial models, suggesting that investors are inefficiently weighting available evidence (Zacharakis & Meyer, 2000).

On the other hand, research on "effectual logic" suggests that an emphasis on "rational" analysis may not actually be key to successful investing. This line of work distinguishes between two orientations that investors bring to the high uncertainty of decision making (Saravathy, 2001; Wiltbank et al., 2006). "Prediction" orientation emphasizes making concrete predictions about how an investment will fare, such as using marketing research, calculating financial models, or otherwise doing evidence-based assessments before deciding. "Control" orientation, on the other hand, emphasizes an investor's ability to control the outcome of the investment, such as via leveraging connections, imaging future courses of action, and thinking about how their own investment will change its probability of success.

The theoretical case for control orientation being more closely-tied to positive investment outcomes than perdition orientation is that control orientation emphasizes acting over managing expectations (Dew et al,. 2008). There is some empirical support for this idea. Angel investors emphasizing prediction make larger investments, theoretically because prediction orientation leads investors to emphasize high-growth markets, but control orientation is linked to better investment results, theoretically because control-

focused investors focus on smaller investments they can control as opposed to betting on predictions about the future (Wilbank et al. 2009). Additionally, experienced investors emphasize effectual logic more than inexperienced investors (Wiltbank, Sudek & Read, 2009).

The current research seeks to bridge the gap between research between decision making in general and investing-specific decision making strategies. Specifically we propose that the negative influence of prediction orientation has been over-stated, as the relationship between prediction orientation and investment outcome depends on an investor's tendency to engage in Actively-Open Minded Thinking (AOT), the "to evaluate arguments and evidence in a way that is not contaminated by one's prior belief" (Staonvich & West, 1997). We suggest that when AOT is relatively high, prediction orientation will be negatively linked to investment outcomes, because investors will feel the need to collect large amounts of information without ever feeling entirely satisfied, hence missing out on key investment opportunities. On the other hand, at lower levels of AOT, investors should feel better about acting on research-informed predictions they have made and therefore have more investment successes.

The concept of AOT was developed to capture people's ability to separate algorithmic application of prior beliefs from rational assessment of argument quality (Stanovich & West, 1997). Since then, it has been applied to a variety of contexts. AOT predicts judgments about who to trust in political contexts (Baron, 2019) belief that humans cause global warming (Stenhouse et al, 2018), accuracy of judgment in cognitive tasks (Haran, Ritov & Mellers, 2013) and being able to guess people's traits such as gender, age and political orientation from social media behavior (Carpenter et al., 2018).

However, each of the above feature contexts quite different from investing, which are characterized by their high stakes, high uncertainty, and job-specific training that will likely encourage venture capitalists to think about investments in ways that differ from their more general reasoning style. While a certain level of AOT is certainly necessary for sound decision in any domain, under high uncertainty, a very high need to see all sides of an issue, even those that are disagreeable, could be a detriment to taking action. Hence, we propose that AOT – a more general construct tapping how people assess evidence - and prediction orientation – an investor-specific construct tapping how investors seek out and weigh evidence – trade off.

The hypothesis of this paper is thus that AOT and prediction orientation interactively predict investment success. People very high on AOT will be hindered by prediction orientation, because they will have a hard time collecting a satisfactory amount of information and be unable to collapse uncertainty into action. However, people with more moderate levels of AOT should be positively impacted by prediction orientation – they collect information have less of a need to collect all available information, so they should be more able to spot and act on potentially good investments.

We use a methodology adapted from Wiltbank et al's (2009) study of how prediction and control orientation are related to angel investor performance. In this study investors complete measures of their reasoning style and prediction and control orientation, as well as their performance as investors by reporting their total number of investments in the past five years and the performance of each. Following Wiltbank et al. (2009), we analyze both the number of exits with negative returns and the number of "homerun" exists (exits with over 100% return). Successful performance could be conceptualized as either fewer negative exits or more homerun exits, and we examine both since we did not have a theoretical basis for narrowing our hypothesis to only one. We do not specify hypotheses regarding control orientation but a reasonable prediction would be to replicate Wiltbank et al.'s finding that control orientation is positive related to investor outcomes. Additionally, we utilize a sample of venture capital investors, so the current work also extends the work previously done on angel investors to a new context.

METHODS

We purchased a contact list of venture capital workers that were actively involved in making investment decisions via Investor Scout and sent e-mail invitations to 6707 contacts. We incentivized participation with a $20 Amazon gift card. The final part of the survey was the rating of investor confidence throughout multiple stages of the investment process, as detailed below. This was a somewhat lengthy measure which led to some participants dropping out before its completion. 134 participants completed all independent, dependent, and co-covariate measures, and of these 108 requested a gift card. An additional 124 participants started the survey and agreed to participate via the consent form, but dropped out at some point while completing the independent, dependent or co-variate measures, and these participants were not included in the final analysis. Of the 145 participants in the final analysis, 83% were male, average age was 49, and the average number of years investing in entrepreneurial ventures was 13.64.

Independent Variables

The full text of all measures was is reproduced in Appendix A. In the first part of the survey, participants completed our measures of reasoning styles. The order of these measures was randomized To measure actively open-minded thinking, participants completed the Haran, Ritov & Mellers (2013) 7-item scale. The scales of prediction and control were adapted from Wiltbank et al. (2009). In the original version, respondents are asked questions about the strategies they would use if they were entrepreneurs trying to invent and market an eye-tracking alternative to computer mouses. The items tap the extent to which strategy would focus on using their network and expertise to influence the future of the product (control), or the extent to which they would gather information and try to predict the future of the market (prediction). In our version, we updated the product to a more contemporary t-shirt with an embedded heart-monitoring advice.

For exploratory purposes we also asked respondents to complete the Feelings Are Truth scale (Stein, Swann& Sarraf, 2020), measures of loss aversion (Bodnaruk & Simonov, 2016, as adapted from Fehr & Goette, 2007) and risk aversion (Bodnaruk & Simonov, 2016, as adapted from Barsky et al., 1997). and the Red Cell reasoning scale (Stein & Jarrin Rueda, 2021).

Dependent & Control Variables

We then measured our dependent variables and co-variates that involved investor performance. These questions were adapted from Wiltbank et al. (2009). In regards to investor performance itself, respondents reported:
Investment size (an exploratory dependent variable), the total amount of money they invested in deals in the past 5 years to the nearest thousand.
Total ventures (a control variable), the number of ventures they invested in in the past five years.

Homeruns and negative exits (key dependent variables) – Participants were asked how many exits they had in the past five years, and then asked to report the performance of these exits. Specifically participants were asked to think about the IRR of each exit and report how many fell into each of these ranges: -100 to 50%, -49 to -25%, -24% to-1%, 0-24%, 25-49%, 50-99%, and over 100%. Negative exits is the number reported in the -100 to -1 ranges, homeruns is the number of reported in the over 100% range.

Following this, participants responded to several other measures of control variables. This set of variables is adapted from Wilbtank et al. (2009), as these variables were all previously identified as being important to investor performance. Using these controls allows a baseline model that allows us to examine the unique contribution to investor performance of prediction and control orientations and AOT.

Investment experience is the how many years they have been investing in entrepreneurial ventures.

Entrepreneurial experience is the number of years they have experience as an entrepreneur (0 for those with no experience).

Seed stage is what percent of their investments are currently in the seed stage, respondents were asked to report the percentage of deals in each of five stages (seed, startup, first, expansion, and bridge; definitions were provided).

Due diligence is how much time they spend on due diligence when evaluating a deal (choices included 1 = less than 1 month, 2 = 1-3 months, 3 = 4-6 months, 4 = 7-9 months, 5 = 10-12 months, 6 = 13-15 months, 7 = 16-18 months, and 8 = more than 18 months).

Prior investments is percentage of deals had other investors prior to their investments (choices included 1 = 0-10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60%, 7 = 61-70%, 8 = 71-80%, 9 = 81-90%, 10 = 91-100%).

For exploratory purposes we also measured what percentage of their deals comes from each of several regions (North America, Europe, Asia, LATAM, Africa, Oceania, and Other), and what percentage of their deals come from each of several industries (agriculture, mining, manufacturing, construction, retail, transportation, hospitality, financial, real estate, ICT, education, healthcare, arts & entertainment, and other).

Finally, as an additional control variable we has participants completed a measure of how confident they were in their ability evaluate several aspects of an investment across different stages of the investment process. Investor overconfidence has is a negative influence on investments in general (e.g., Statma, Thorley & Vorkink, 2006)and in venture capital investing specifically, because it leads to the overestimation of the probability of events that would lead to high return (e.g. ,Graves & Ringuest, 2018; Zacharakis & Shepherd, 2001). We include confidence in our baseline model because our hypotheses about the interactive effect of prediction and AOT involve needs for information before making decisions rather than evaluations of theoretical evaluability.

We used a simplified version of Kollman & Kuckertz's (2010) measure of investment confidence. In our measure, participants rated the degree to which they think it is possible (1-4, 1 = Not at all possible, 4 = Very possible) to evaluate five separate aspects of the investment process (product or service quality, market potential, financial potential, experience of the entrepreneur, and personality of the entrepreneur) at four different stages of the investment process (during the initial screening stage, during the due diligence stage, during the deal structuring process, and after deal structuring), for a total of twenty different judgments. We created indices of each aspect of the process by averaging across the ratings for each stage. Since the different aspects of the investment process are evaluated differently (Kollman & Kuckertz, 2010), we treated each of these five variables as individual controls.

RESULTS

Descriptive statistics and correlations among key variables are in Table 1. The Actively-Open Minded Thinking (AOT) scale showed good reliability (α = .65), as did the measures of prediction orientation (α = .76) and control orientation (α = .70).

Main Analyses

To test our hypotheses regarding how prediction and orientation would interact with AOT to predict investor performance, we ran a series of regression models. The dependent variables were number of homerun exits, and negative exits. Since those are both count variables, we ran Poisson regression models. For each dependent variable we ran two models. One "baseline" model consisted just of our set of covariates. The other also included our key predictors, prediction orientation, control orientation, and Actively Open-Minded Thinking (AOT), and the interaction between prediction orientation and control. For exploratory purposes we also included the interaction between control orientation and AOT.

Full results of these regression models are in Table 2. Most critically, the regression using homerun exits revealed a main effect of prediction (B= 1.97, p < .001) and AOT (B = 2.58, p = .01). However, these main effects were qualified as predicted by a two-way interaction (B = -.29, p < .001). Neither the main effect of control orientation nor its interaction with AOT were significant predictors of homerun exits (p's > .04). When looking at regression models with negative outcomes as the dependent variable, none of the effects involving AOT, prediction, control, and the AOT x prediction and AOT x control were significant at the p < .05 level, although the AOT x control interaction was marginally significant (B = -.06, p = .09).

In summary, then, there is strong support for the idea that prediction orientation and AOT interact to predict investor performance in the form of their interactive effect on number of homerun exists. This interaction is plotted in Figure 1. As hypothesized, there is a crossover effect such that at lower levels of AOT, prediction orientation has a positive relationship with number of homerun exists, while at higher levels of AOT prediction orientation has a negative relationship with number of exits.
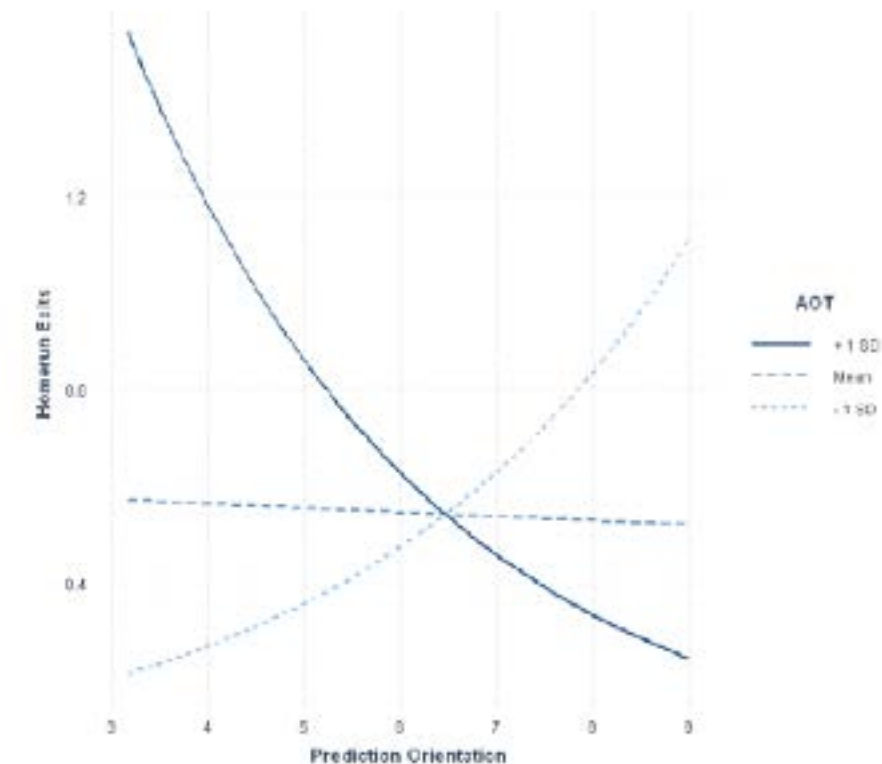
Figure 1. The interactive effect of prediction orientation and AOT on number of homerun exit

It should be noted that the overall means of both prediction orientation (M = 6.64, SD = 1.28) and AOT (M = 6.88, SD = 1.11) are high in relation to their scale (both rounding up to 7 out of a 9-point scale), so "low" AOT and prediction orientation should be considered in a relative sense. Presumably since AOT and prediction orientation both involve wanting to see and evaluate evidence before making a decision, being truly low on either would be a detriment to decision making, so the analyses here should be taken as comparing more moderate levels to more excessive levels that might prevent decision making from taking place.

For exploratory purposes we also ran linear regression models with investment size dependent variable. Interestingly, this model also revealed a significant interaction of AOT and prediction orientation in the same direction as the effect on number of homerun exits.

DISCUSSION

The results presented here bridge ideas from decision making in general with research on "effectual logic" specific to investing decisions. We build on prior work by showing that the relationship between prediction orientation and investment success is dependent on the extent to which investors engage in Actively-Open Minded Thinking (AOT). Prediction orientation is related to lesser investor success when AOT is high, but greater investor success when AOT is low. So, research suggesting that prediction orientation is a detriment to (Wiltbank et al., 2006) or merely neutral (Wilbank et al., 2009) with regard to investor success might have prematurely concluded that prediction orientation is lesser to control orientation. Conversely, the literature on actively-open minded thinking in isolation would suggest that AOT would be uniformly related to investor success (e.g., Haran, Ritov & Mellers, 2013), but we have shown that is not the case.

An interesting implication of these results is that generalized reasoning style, as measured by AOT, and investor-specific reasoning, as measured by prediction and control orientation, are independent constructs, as they are all uncorrelated (see Table 1). So, investors have learned, or just naturally have, ways of reasoning about investments that are psychologically distinct from how they reason more generally. But, their more general reasoning style still ultimately shapes their investment outcomes. Thus, investors seemingly don't have singular approaches to how they think about investments, they have more general and more specific ways of reasoning about investments. Further research should aim to pinpoint when in the stages of an investment one reasoning construct is more salient than another.

Notably, while Wiltbank et al. (2009) found that control orientation was associated with investor success via predicting fewer negative exits, we found only a marginal interaction between control orientation and AOT, and no main effect of control orientation. This interaction suggests that at lower levels of AOT, control orientation leads to more negative exits, while at higher levels of AOT control orientation leads to fewer negative exits. This perhaps suggest that feeling control over an investment while lacking an ability to evaluate whether that feeling is warranted can lead to more subpar investments, but given the inconclusiveness of the results such a conclusion would be very tentative. Nonetheless, we again see more evidence that effectual logic depends on general reasoning style when predicting investment outcomes.

One limitation of the current research is that investors are asked to report on their outcomes in retrospect over a period of years, meaning we do not have much data-driven insight into the process by which prediction orientation and AOT affect individual investment decisions. This is important to note since other research has found prediction and control orientation can fluctuate in importance depending on the stage of the investment process (Wiltbank et al., 2006). We theoretically think our effects obtain due to judgments that a sufficient amount of good information has been found and willingness to act on that information, but we are unable to show that process with the data here. Additionally, the lack of process measures puts a limitation on the implications of our findings. Thus while the results suggest an overall interactive effect between AOT and prediction orientation, with low AOT and high prediction orientation leading to most successes, that particular combination of thinking styles might not always be optimal depending on stage of the process.

CONCLUSION

The current research suggests that effectual logic needs to be considered alongside more general reasoning style. Further research should consider how other constructs identified as important to investor decision making might also interact with reasoning constructs like AOT. We hopefully push debates on how investors deal with uncertainty beyond a distinction between whether investors are being rational/analytical vs. intuitive/driven by heuristics by pointing out that the same investor can be all those things at once, and what seems to help investor performance according to our results is investor's ability to put appropriate bounds on those tendencies, so we encourage further research that also measures reasoning style at multiple levels.

Table 1.   Correlations and Descriptive Statistics.

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.Total venture investments in the past 5 years past 5 years?	20.98	20.29																	
2.Experience investing in entrepreneurial ventures (years)	13.56	9.27	0.04																
3.Entrepreneurial experience (years)	7.92	9.35	0.16	0.51**															
4.Time spent on due diligence	1.99	0.90	-0.26*	0.01	-0.05														
5.Share of investments with prior investments	6.18	3.03	0.08	-0.15	-0.21*	-0.1													
6.Share of investments currently in seed stage	19.83	26.24	0.26*	-0.03	0.08	-0.07	0.34**												
7.Product certainty	2.97	0.73	-0.03	0.06	0.02	-0.01	0.18*	0.28**	.79										
8.Market certainty	3.22	0.65	-0.2*	-0.18*	-0.07	0.04	0.13	-0.14	0.34**	.81									
9.Financial certainty	3.01	0.64	-0.14	-0.07	0.03	0	0.19*	-0.19*	0.39**	0.55**	.81								
10.Experience certainty	3.48	0.55	-0.03	-0.04	0.05	0.02	-0.07	-0.03	0.27**	0.34**	0.19*	.76							
11.Personality certainty	3.22	0.65	-0.09	-0.16	-0.09	-0.07	0.14	-0.06	0.35**	0.36**	0.36**	0.53**	.78						
12.Prediction orientation	6.64	1.28	0.03	-0.08	-0.06	0.04	0.11	-0.06	0.24*	0.23*	0.16	0.11	0.12	.78					
13.Control orientation	6.97	0.97	0.12	0.05	0.17*	-0.17*	0.11	-0.1	0.06	0.21*	0.02	0.03	0.07	0.03	.69				
14.Actively open-minded thinking	6.88	1.11	0.11	-0.03	-0.11	0	0.04	-0.03	0.06	-0.07	-0.02	0.01	-0.02	0.12	-0.04	.67			

15.Homerun exits	0.75	1.28	0.18*	0.24*	0.07	-0.16*	-0.02	0.07	0.1	-0.05	-0.1	0.08	-0.04	0.01	0.03	0.03	
16.Negative exits	0.91	1.81	0.42**	0.22*	0.08	-0.11	0.04	0.15	0.03	-0.1	0.03	0.08	0.01	0.04	-0.01	0.08	0.17*
17.Investment size	$4.38M	$7.24M	-0.2*	-0.01	-0.12	0.3**	0.08	-0.2*	0.08	0.01	0.06	-0.03	-0.03	-0.14	0.15	0.01	-0.02	-0.09

Scale reliabilities are in the diagonal where applicable.
*p < .05
** p < .001

Table 2. Regression models with number of homerun exits, number of negative exits, and investment size as dependent variables.

Homerun exits (Poisson regression)

	Baseline model			Whole model		
	Estimate	Std. Err	p	Estimate	Std. Err	p
Intercept	**-1.77**	**0.98**	**0.07**	-19.04	7.39	0.01
Total ventures	0.00	0.01	0.64	0.00	0.01	0.67
Experience investing (years)	**0.07**	**0.01**	**0.00**	**0.06**	**0.01**	**0.00**
Experience as entrepreneur (years)	**-0.03**	**0.01**	**0.01**	**-0.04**	**0.01**	**0.01**
Due diligence (8-point scale)	**-0.55**	**0.16**	**0.00**	**-0.69**	**0.18**	**0.00**
Deals with other investments (10-point scale)	0.00	0.04	0.96	0.00	0.04	0.98
Share of investments in seed stage	0.01	0.00	0.19	0.00	0.00	0.24
Product certainty (4-point scale)	**0.42**	**0.17**	**0.02**	**0.51**	**0.18**	**0.00**
Market certainty (4-point scale)	0.06	0.20	0.75	0.08	0.23	0.72
Financial certainty (4-point scale)	-0.35	0.19	0.06	**-0.45**	**0.20**	**0.02**
Experience certainty (4-point scale_	0.44	0.22	0.05	0.29	0.24	0.24
Personality certainty (4-point scale)	-0.08	0.17	0.66	-0.04	0.18	0.84
Prediction				**1.97**	**0.60**	**0.00**
AOT				**2.58**	**1.04**	**0.01**
Control				0.74	0.89	0.40
AOT x Control				-0.10	0.13	0.42
AOT x Prediction				**-0.29**	**0.09**	**0.00**
χ2	55			70		
df	11			16		
p(χ2)	< .001			< .001		

Negative exits (Poisson regression)

	Baseline model			Whole model		
	Estimate	Std. Err	p	Estimate	Std. Err	p
Intercept	**-4.32**	**0.89**	**0.00**	-16.47	6.59	0.01
Total ventures	0.03	0.00	0.00	0.03	0.00	0.00
Experience investing (years)	**0.06**	**0.01**	**0.00**	**0.07**	**0.01**	**0.00**
Experience as entrepreneur (years)	**-0.03**	**0.01**	**0.01**	**-0.03**	**0.01**	**0.01**
Due diligence (8-point scale)	-0.16	0.12	0.21	-0.21	0.14	0.14
Deals with other investments (10-point scale)	0.04	0.04	0.27	0.06	0.04	0.13
Share of investments in seed stage	0.00	0.00	0.29	0.00	0.00	0.35
Product certainty (4-point scale)	**0.11**	**0.16**	**0.47**	**0.04**	**0.16**	**0.79**

Market certainty (4-point scale)	-0.16	0.19	0.40	-0.29	0.21	0.15
Financial certainty (4-point scale)	0.24	0.17	0.15	**0.25**	**0.18**	**0.17**
Experience certainty (4-point scale_	0.55	0.20	0.01	0.55	0.21	0.01
Personality certainty (4-point scale)	0.09	0.17	0.61	0.18	0.18	0.31
Prediction				**0.61**	**0.60**	**0.31**
AOT				**1.70**	**0.91**	**0.06**
Control				1.30	0.85	0.13
AOT x Control				-0.20	0.12	0.10
AOT x Prediction				**-0.06**	**0.09**	**0.46**
χ2	124			135		
df	11			16		
p(χ2)	< .001			< .001		

Investment size (Linear regression)

	Baseline model			Whole model		
	Estimate	Std. Err	p	Estimate	Std. Err	p
Intercept	2069676	5397021	2069676	-71403491	37802242	0.06
Total ventures	-59834	35476	-59834	**-76340**	**34267**	**0.03**
Experience investing (years)	12209	81677	12209	-11865	78014	0.88
Experience as entrepreneur (years)	-59790	82397	-59790	-96534	79128	0.23
Due diligence (8-point scale)	**2203670**	**674565**	**2203670**	**2280093**	**674146**	**0.00**
Deals with other investments (10-point scale)	181780	233008	181780	-36120	232991	0.88
Share of investments in seed stage	-27226	25187	-27226	-25823	23919	0.28
Product certainty (4-point scale)	772775	995104	772775	1255019	961709	0.19
Market certainty (4-point scale)	-1058154	1200674	-1058154	-1840644	1245536	0.14
Financial certainty (4-point scale)	392884	1225366	392884	639659	1175434	0.59
Experience certainty (4-point scale_	33719	1338842	33719	102037	1284379	0.94
Personality certainty (4-point scale)	-420352	1210581	-420352	-704593	1152223	0.54
Prediction				5772953	3103956	0.07
AOT				9246203	5403989	0.09
Control				4697487	4833802	0.33
AOT x Control				-339099	684936	0.62
AOT x Prediction				**-915336**	**442099**	**0.04**
R²	0.18			0.30		
p(R²)	0.01			< .001		

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Appendix A

(Full Survey Text)

For some issues, there are correct and incorrect answers that can be found or verified. But, for other

issues, different people may reach different conclusions. For instance, you may have a different

interpretation of a movie's meaning or message than someone else, and you might say that both

perspectives are correct. Other issues might seem in-between – there might be some standard of

judgment that's relevant to the issue, but also people can create their own meaning from their

perspective. Please consider each issue below and rate the two subsequent statements. (Strongly

disagree 0 – Strongly agree 9)

1. How funny a movie is

2. How good a cup of coffee is

3. Which of the past five decades had the best music

4. Whether a slice of cake is too sweet

5. Why the Great Depression happened

6. The causes of unemployment

7. The causes of WW1

8. Whether using cell phones has an adverse effect on physical health

9. Why yeast causes bread to rise

10. How light bulbs work

11. Whether a certain chemical is an effective paint thinner

12. So we know you're not a bot, for this one please answer with the leftmost choice ("Strongly
    disagree") for the first item and the rightmost choice ("Strongly agree") on the second item.

13. Why fog forms

Appendix B

Please rate the extent to which you agree with each of the following statements. (Strongly disagree 0 –

Strongly agree 8)

(Actively Open-minded Thinking Scale, AOT)

1. I have no patience for arguments I disagree with.

2. I often "tune out" messages I disagree with.

3. I believe it is a waste of time to pay attention to certain ideas.

4. I try to reserve judgment until I have a chance to hear arguments from both sides of an issue.

5. I am open to considering other viewpoints.

6. When thinking about a issue, I consider as many different opinions as possible.

(Feelings Are Truth Scale)

1. People know, deep down, what's true and what's not.

2. Some people have intuitive senses of what is true and what is not.

3. A gut belief that something is not true is a good reason to think it's not true.

4. Intuition can reveal more truth about a situation than objective facts.

5. Gut feelings are a kind of truth.

(Covid-19 Symbolism scale)

To what extent do you agree with the following statements about coronavirus-related restrictions and

guidelines? (Strongly disagree 0 – Strongly agree 8)

1. By imposing restrictions that limit what businesses can be open during the pandemic, we are
   letting the virus win.

2. Wearing a mask is a sign of weakness.

3. Having gatherings that violate social distancing guidelines is a way of asserting freedom.

4. Continuous coronavirus coverage in the media has been a sign that we are losing.

5. Following coronavirus prevention guidelines means you have backed down.

Appendix C

Please use your imagination, put yourself in the context of the scenario, and answer each question as if you were CEO:

During your 12-year tenure as an engineer at a major computer hardware manufacturer, you work on your own time to invent a heart-monitoring device can be imbedded into t-shirts. You imagine it has great applications for both athletes and those with heart conditions. You are convinced that there is a huge potential for change in the way things are currently done. But when you attempt to interest your current company in licensing the idea from you, they are uninterested. There are no firms currently offering anything close to this, and you possess all the technical skills to create the product effectively and efficiently. You quit your job to further develop this idea. (Strongly disagree 0 – Strongly agree 8)

1. As you assemble information on this business, you would:

    a. Talk with people you know to enlist their support in making this become a reality. (C)

    b. Study expert predictions of where the market is "heading". (P)

2. As you develop a marketing approach for this product you will:

    a. Research the competitors' approaches. (P)

    b. Imagine possible courses of action based on your prior experience. (C)

3. When you think about the uncertainty of a market for this idea, you move forward anyway

    because:

    a. Your expertise allows you to influence that uncertainty. (C)

    b. Your actions can create a future you value. (C)

4. As you manage product development, you will be driven by:

    a. Comparing your progress against the development of competitors. (P)

    b. Creating new solutions on your own terms, any competitors will have to keep up. (C)

5. If you were to look at predictions for where potential markets are heading you would:

    a. Use them to create forecasts of what your business might accomplish over time. (P)

    b. Discount them as they do not incorporate the impact of your innovation. (C)

6. In situations like this, it is important to base strategy on:

    a. Relevant forecasts and analyses. (P)

    b. What you are capable of, given the means available to you. (C)

7. As you learn about the expectations other people have for this industry, you:

    a. Imagine ways your venture will change aspects of the situation they are forecasting. (C)

    b. Form updated predictions of likely outcomes for the business. (P)

Appendix D

Below is the description of two lotteries. Read each carefully, and note whether you would participate in or reject each.

Lottery A: Win $6 with probability 1/2, lose $4 with probability 1/2. If you reject this lottery, you receive nothing. (I would participate/not participate)

Lottery B: This lottery consists of six independent repetitions of Lottery A. If you reject this lottery, you receive nothing. (I would participate/not participate)

Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your (family) income and 50-50 chance that it will cut your (family) income by a third. Would you take the new job? (Y/N)

Suppose the chances were 50-50 that it would double your (family) income and 50-50 chance that it will cut it in half. Would you still take the new job? (Y/N)

Suppose the chances were 50-50 that it would double your (family) income and 50-50 chance that it will cut it by 20% percent. Would you take the new job? (Y/N)

Appendix E

These were questions we asked directly to our participants to learn more about their experience and past deals.

1. What firm do you currently work for?
2. What is your current job title?
3. How much money did you invest in deals in the past 5 years (in dollars, to the nearest thousand)?
4. How many ventures did you invest in during the past 5 years?
5. How many exits did you have in the past 5 years?
6. Please think of the approximate IRR of each of the exits you had. How many of those IRRs fall into each of the following ranges below.
   a. -100 to 50%
   b. -49 to - 25%
   c. -24 to -1%
   d. 0-24%
   e. 25-49%
   f. 50-99%
   g. Over 100%

Appendix F

1. How long have you been investing in entrepreneurial ventures? Provide the number of years.

2. Do you have experience of starting your own business? (Y/N)

3. Please evaluate the average stage of companies you are currently invested in (100% total).

    Since different investors may have different definitions of each of these stages, here is how we

    are defining them: (Seed, Startup, First Stage, Expansion Stage, Bridge)

The Seed Stage

Entrepreneurs spend most of this stage convincing investors that their ideas for a product or service

represent a viable investment opportunity. Funding amounts in the seed stage are generally small, and

are largely used for things like marketing research, product development, and business expansion, with

the goal of creating a prototype to attract additional investors in later funding rounds.

The Startup Stage

Companies have typically completed research and development and devised a business plan, have a

prototype, and are now ready to begin advertising and marketing. At this stage, businesses need a larger

infusion of cash to fine tune their products and services, expand their personnel, and conducting any

remaining research necessary to support an official business launch.

The First Stage

Sometimes also called the "emerging stage," first stage financing typically coincides with the company's

market launch, when the company is finally about to start seeing a profit. Funds from this phase of a

venture capital financing typically go to actual product manufacturing and sales, as well as increased

marketing. Funding amounts in this stage tend to be much higher than in previous stages.

The Expansion Stage

Also commonly referred to as the second or third stages, the expansion stage is when the company is

seeing exponential growth and needs additional funding to keep up with the demands. Because the

business likely already has a commercially viable product and is starting to see some profitability,

venture capital funding in the emerging stage is largely used to grow the business even further through

market expansion and product diversification.

The Bridge Stage

The final stage of venture capital financing, the bridge stage is when companies have reached maturity.

Funding obtained here is typically used to support activities like mergers, acquisitions, or IPOs. The

bridge state is essentially a transition to the company being a full-fledged, viable business. At this time,

many investors choose to sell their shares and end their relationship with the company, often receiving

a significant return on their investments.

4. On average, how much time do you spend on due diligence when evaluating a deal? (Less than 1

    month, 1-3 months, 4-6 months, 7-9 months, 10-12 months, 13-15 months, 16-18 months, more

    than 18 months)

5. What percentage of your deals had other investors prior to your investment? (0-10%, 11-20%,

    21-30%, 31-40%, 41-50%, 51-60%, 61-70%, 71-80%, 81-90%, 91-100%)

6. Approximately what percentage of your deals come from each of the following regions? (North

    America, Europe, Asia, LATAM, Africa, Oceania, Other)

7. Approximately what percentage of your deals come from each of the following industries?

    (Agriculture, Mining, Manufacturing, Construction, Retail, Transportation, Hospitality, Financial,

    Real Estate, ICT, Education, Healthcare, Art and Entertainment, Other)

Appendix G

During the investment evaluation process, to what degree is it possible for you to evaluate each of the following aspects of a typical investment proposal?

	During the initial screening stage	During the due diligence stage	During the deal structuring process	After deal structuring
Product or service quality	˅	˅	˅	˅
Market potential	˅	˅	˅	˅
Financial potential	˅	˅	˅	˅
Experience of the entrepreneur team	˅	˅	˅	˅
Personality of the entrepreneur team	˅	˅	˅	˅

Our participants were given these answer options (Not at all possible, somewhat possible, moderately

possible, very possible)

Solis Diana*	Healing Circles in Academia: Creating Radical Transformative Self-Care

Acknowledgements

Abstract

Having Healing Circles as a tool not only aided me in coping with racism, microaggressions, sexism, imposter syndrome, and mental health, but it gifted me with empowerment and a sense of identity as a Xicana. My research on Healing Circles focuses on intersectionality, decoloniality, and feminism of color resistance and pedagogy. Healing Circles offer a framework of radical transformative healing tools, particularly for BIPOC non-binary womxn. They offer an intervention to institutional disembodiment. Feminist of color scholars, including Stephanie Cariaga, discuss how institutional disembodiment creates more trauma by forcing a violent separation between the mind and body of students and educators. [SK6] Most scholars write about healing circles as community-centered practice and as an alternative way to decolonize health care. This paper argues that Healing Circles can be used as a tool in academia to help heal faculty and students in Ethnic Studies.

There is an imbalance in Ethnic Studies between learning about oppression and learning about resistance, what feminist Queer Chicana Scholar, Gloria Anzaldua calls the dark versus the light, respectively. My research question is designed to answer how to focus more on the "light" as a way of healing, especially in Ethnic Studies. The methods I plan to use are Testimonio, Digital ethnography, or Healing-Centered Engagement Theory. Anticipated results are that students and educators reclaim their healing. Since there are few to no Healing Circles in academia, after doing this project I hope to develop a workshop series for institutions outside of Cal Poly.

Introduction

My research states there is an imbalance in Ethnic Studies between learning about oppression and learning about resistance, what feminist Queer Chicana Scholar, Gloria Anzaldua calls the dark versus the light, respectively. Feminist of Color scholars, including Stephanie Cariaga, discuss how institutional disembodiment creates more trauma by forcing a violent separation between the mind and body of students and educators.

Critical Race Theory / Ethnic Studies is being banned in colleges/schools throughout states in America. Such as: Texas, Florida, Oklahoma, North Carolina, Tennessee, and Idaho. The narrative they are trying to create is that Ethnic Studies is in opposition to white supremacy for students to learn. Many republicans are trying to "Shield their kids from uncomfortable conversations about race." (NPR, 2021) While this is going outside of the academic institutions, we are also dealing with a problem within the inside of the institution.

This research argues that Healing Circles can be used as a tool in academia to help heal faculty and students in Ethnic Studies. Healing Circles, also known as Talking Circles, are deeply rooted in traditional practices of indigenous people around the world. In Healing Circle, there are three important aspects. First, is the intention of a Healing Circle is for people to come together to create a safe space. Second, because there is no hierarchy in a Healing Circle, tough issues can be faced in a gentle way. Third, Healing Circle offers a grounding approach to healing by having participants learn to listen without reacting, be present, and speak from the heart. A common theme I came across is that Healing Circles can help heal trauma. Healing Circles have been implemented in different methodologies.

From health to restorative justice. Healing circles are creating an immense impact.

Healing Circles can provide positive communication skills, mutual trust, respect, and understanding, and most importantly a closing space. What this signifies is that in Circle, whatever subject matter is discussed you can release it in a gentle loving way. It no longer serves you. You can release it to the Circle and be able to move on from it. This acts to liberate whatever trauma you have faced. You are doing this while having the support of everyone in the circle unapologetically supporting you. These components are missing from Ethnic Studies pedagogy and from the classroom.

My research question asks, how can healing circles support BIPOC educators and students as they navigate and heal from the oppression and reopened traumas they experience in the Ethnic Studies classroom? My expected outcome with this work is that students and educators reclaim their healing. They will reclaim their healing through the methods design of my research. Anticipated results are a major cultural shift in the pedagogy (how we go about teaching ethnic studies). How we teach is vastly outdated. We have been educating students from colonial Eurocentric standards. Which is creating real implications with the current curriculum. Curriculum that does not fit the Eurocentric model, that is there to dismantle white supremacy is being banned. This is creating urgency, and it is why we need to have a healing approach to Ethnic Studies. So, we can make sure Ethnic Studies is being taught across all states. Centering body, mind, and spirit in academia by collaborating with community healing circles will bring awareness to radical self-care.

Literature Review

Benavides Lopez, C. (2016). Critical Race Insights from the Corazon/Heart: Pedagogy and Practice toward Healing in Ethnic Studies. nineteen sixty nine: an ethnic studies journal, 3(1). Retrieved from https://escholarship.org/uc/item/2mk6d1cb

In this article, the strengths that the author presents are that they are centering experimental knowledge and lived experience for students. They are using a method that is teaching from the heart pedagogy. Using Critical Race Pedagogy. This is important because they are implementing a collective method of valuing the students and centering them in the research. A gap in the literature is that they are using testimonios to center struggle and survival. Teachers are being vulnerable and bear the responsibility of guiding students through inquiry and self-reflexivity. This connects to my research by being able to bridge that gap in literature. My study can engage in this by offering healing circles as a gentle way to handle the healing wounds and empowerment and can lead to an even stronger testimonios. Healing shouldn't be seen as an assignment. A student's grades should not be on the line whether they are comfortable talking about trauma they have endured. Author acknowledges that students face difficult moments of awareness throughout the semester and healing circles can be there to honor those feelings. Educational institution can be an emotional prison. Healing circles can free them.

Nicol, D., & Yee, J. (2017). "Reclaiming Our Time": Women of Color Faculty and Radical Self- Care in the Academy. Feminist Teacher, 27(2-3), 133-156. doi:10.5406/ femteacher.27.2-3.0133

In this article, the strength the author provide is that they define the term radical self-care. This framework is centered because involves directing and owning their lives and being unapologetic.They point out that strong cultural identity equals self-care. This is connecting with my research because Healing Circles values culture and healing. They also highlight they are intertwined and need one another to fully support the individual. Self-care literally saved both theirs lives (from health issues). The authors also acknowledge the power of teaching intersectionality and ethic care (about race). A gap in the literature is that they play "mommy role" for BIPOC students dealing with trauma was often. They do not provide a structure for that trauma mending. My research fulfills that gap in the literature. It demonstrates why it is needed not only for students but for educators as well. It can be part of the praxis they teach. They explain how radical self-care shaped them to draw boundaries and non-negotiable habits. Things that students need to also learn. Academia can create toxic habits for students and staff. Healing circles can intervene that.

Richardson, Jennifer. (2018). Healing Circles as Black Feminist Pedagogical Interventions. 10.1007/978-3-319-65789-9_16.

In this article, a strength that is author acknowledges that students of color often feel (re)traumatized by academic spaces. Her framework on the circle is meant for black women addressing the impacts of symbolic forms of media violence. Healing circles are centered around black feminism. Richardson also states that spaces need to be intentionally provided in healing practices in classrooms. This connects with my research because it affirms that healing needs to be intentional and having the safe space to provide that is essential. The gap in this literature is that it was only conducted outside of the academia but states it would work in academy setting. My research can be used in the framework with Ethnic Studies and how the students feel impacted by it. My framework will also follow the intersectional lens. I can fill in the gap with incorporating healing circles in academic setting. Author mentions that she spent a lot of time of what's "wrong" and not enough on reimagining how to make things right. I can create the shift to focus on the "light" and move away of "wrong" that can also be consider "dark" narrative.

Taylor, S. R. (2018). The body is not an apology: The power of radical self-love.

The article strength is that it makes a strong connection with why radical self-love relatesto the body. This connects to my study because I argue we need to center mind body and soul into the healing in academia. The "ills" of the world such as violence, poverty, injustice is all connected directly with the body. It is intersectional and has disable bodies as a center framework around radical self-love. Author states we need see ourselves as whole. This connects with my healing center engagement framework because it is defined to make students feel whole. That they are more than their trauma. My study can engage with this because if these ills have an impact with the body, it is proving that academia is creating an impact to our body as well. Because we are learning about these ills in the world. Healing circles can mend that and create a self-compassion.

Cantú-Sánchez, M., de León-Zepeda, C., & Cantú, N.E. (2020). Teaching Gloria E. Anzaldúa: Pedagogy and Practice for Our Classrooms and Communities. Tucson: University of Arizona Press.

Theoretical Framework

My research on Healing Circles focuses on three theoretical frameworks. LATCRIT, Ethnic Studies Pedagogy, and Intersectional Feminism. The first framework is LatCrit is a theoretical branch extending from CRT is Latina/o Critical Race Theory (LatCrit), which examines experiences unique to the Latina/o community such as immigration status, language, ethnicity, and culture (Solorano & Delgado Bernal, 2001). I chose LATCRIT since I identify as a Latina, this framework best aligns with PAR for the methods approach. I am using a decolonial approach to my methods and this framework validates my experience as a participant in attending the Healing Circles.

The second framework is Intersectional feminism. "A prism for seeing the way in which various forms of inequality often operate together and exacerbate each other," (cf. Crenshaw, 1989). Intersectionality is something that I value and want to make sure I honor people as a whole individual with my study. My study is centering the people who are often marginalized. My research participants are BIPOC students, and they often experience a multitude form of oppression. My research centers and honors their lived experienced.

My third framework is Ethnic Studies Pedagogy, which is "Building upon students' experiences and perspectives, developing students' critical consciousness, and creating caring academic environments." (Tintiangco-Cubales, A., Kohli, R., Sacramento, J. et al., 2015) This Pedagogy approach ties into my study since it's all about decolonizing as a liberatory process and that is essential to radical transformative self-care. This framework illustrates what the future of Ethnic Studies is heading towards. It is centering students lived experience. It is seeing students as a whole and making them be seen more than just a standardized test score. Students go through an influx of different emotions and events while being in school. This framework also validates the importance of creating a healing component into Ethnic Studies.

These three frameworks interweave well with each other. Together they are complimentary to my research. Ethnic Studies Pedagogy and LatCrit are a great example of how they support my research. Ethnic Studies Pedagogy argues that my lived experienced is as valuable as how I perform as a student. While LatCrit demonstrates how my cultural experience has affected me and my lived experienced. Putting this together supports BIPOC students experience in the classroom. If we bring up cultural issues and histories in classrooms without any additional support, it makes sense why students might feel trauma in a classroom.

Methods

To collect data, I had to go through the IRB research process to get approved on my methods approach. I was doing a mixed-method approach. I attended a Healing Circle and was going to conduct semi-formal interviews.

Once I got IRB cleared, I went ahead and made a flyer to recruit participants for my research interviews. I had participants email myself or I personally reached out to them. After screening the participants if they met my requirements, I went ahead and schedule interviews through Calendly and Outlook. Because of being in a pandemic, my interviews were all conducted via zoom. To ensure in-depth data and external validity, sample size is 16 participants. From the 16 interview participants, 9 were students and 7 were professors. From the 9 students, I had 6 who were in undergrad, and I have 3 who were graduate students. Once I scheduled my interviews, I had a script with a series of questions broken down into 3 different categories. To collect applicable data and to ensure internal validity, all participants will be asked questions from the same script, and their responses will remain anonymous. I as the researcher asked each participant to provide a pseudonym for future publication purposes. The first category was on general questions about themselves and Ethnic Studies. The second category was on radical self- care and healing. The last category was divided into students and faculty specific questions. I recorded through zoom and was able to obtain a copy of my transcript through it.

With my second method of Participatory Action Research (PAR) I reached out the Womxn of Color Collective where I had reached out and planned to attend a Healing Circle. Because we were in a pandemic, they had postponed all Healing Circles in person. With the lack of resources, it was difficult to get support to put on another Healing Circle. My alternate HC was attending one with the Native American Student Center at Cal-Poly. I ended up attending a Weaving Healing Circle. Which it was my first time doing so. I gathered my data my being present and participating in the activity of weaving basket. I also made sure to be present be Intune with how my body and emotions reacted throughout the process, speak up and observe and listen to others. Afterwards I wrote a summary of my experience with the Healing Circles.

I attended was the Weaving Healing Circle a collaborative project event hosted by the Native American Student Center at Cal-Poly Pomona (NASC) and Native American Scholars/Elder-In Residence. It was a California Indian Ways of Knowing: Traditional Cultures Series. I attended Series 1: California Baskets the Tradition Lives On. The event took place on March 15th from 5-7pm. It was located on campus by the stables, it was held in the conference room named the Rainbow Weaver that is next to the NASC Office. They also host Beading Circle events too. Students, faculty, and community members were able to attend. It ended up being a great turn out. We had a great mixture of diverse students attending. Many it was their first time doing a weaving circle. Dr. Dixon brought her class to participate in the circle. There was a CPP faculty present, a grad student and the rest of the students were from undergrad. There was also one student who was from Mt. San Antonio who was recently admitted attending the event. And lastly, the social justice staff from NASC were in attendance to help the facilitator run the event and support her.

I enjoyed the event so much. It was my first-time doing a weaving basket. I had previously participated in attending Healing Circles but never with doing an activity such as weaving or beading. I appreciated how supportive the elder facilitator was throughout the event. She helped every student start their basket and was hands on in helping students if they got stuck in it. I also liked how the facilitator asked everyone how they were all connected to earth as the opening. This question connected everyone and how each person had a unique experience with earth. Some people mentioned how they were connected to earth because themselves or family members worked as farmers or in agriculture. There was a student who said their grandmother was a cotton picker from the south. My connection to the earth was through my grandfather. He was a Bracero who picked fruit in the Coachella Valley Dessert. It was very educational, and they broke down the basket weaving meaning and purposes to use basking weaving. The material used for the basket was round reed. I was focused and concentrated on weaving the basket. I struggled to get the basket started, so I had the elder help me out. I kept repeating "over & under" for this basket pattern. Once the strip of grass ended, I had to go back and weave another one where I left off and make sure to blend it in.

Here is a sample of my interview script with questions:

The following questions focus on Ethnic Studies and your experience in these courses.
Part 1 General Interview Questions:
1. Why do you think it is important to learn about Ethnic Studies? What do you identify as potential benefits?
2. When in your academic journey did you first see the stories and histories of your racial/ethnic communities represented?
3. When did you take your first Ethnic Studies course?
4. When you finished your first Ethnic Studies course, did you feel empowered? If so, how?

This is the end of Part 1 of the interview. [Rest/let me know when you are ready to move on]

The following question focus on radical self-care and healing.

Part 2 General Interview Questions:
1. Womxn of Color Sister Collective defines radical self-care this way: "Loving ourselves as BIWOC [Black, Indigenous, Women of Colo] is an act of resistance. The world teaches us to constantly rely on oppressive systems that put value on our self-worth. By loving ourselves beyond their standards, we take the power back. Radical self-love is digging deeper into past beliefs and healing them." Given this definition, do you have a radical self-love healing practice? If so, what is it? If not, is it something you would consider?
2. A Healing Circles, also known as Talking Circles, are an indigenous practice of sharing emotions and feelings and healing traumas in non-hierarchal, communal ways. Are you familiar with Healing Circles? If yes, what do you know about them?

Now that we have talked about Ethnic Studies and Healing Circles, we are going to explore the possibility of what our classrooms and classroom experiences could be like with we merged both.

Part 3 Questions for Faculty Teaching Ethnic Studies
1. If you are comfortable, please share the name(s) of the institution(s) where you teach.
2. As an instructor of Ethnic Studies, what are some ways you decolonize the classroom?
3. How do you navigate teaching really heavy concepts (like, for example, historical and contemporary oppressions/events) in the classroom?
1. How does teaching this material impact your mind, body, spirit?
2. How do you cope?
4. As an instructor of color teaching Ethnic Studies, what are the feelings that you experience teaching the material?
5. Have you reclaimed your own healing in academia? If so, in what ways?
6. What are some healing practices that you exercise in the classroom?
1. How do these practices feel for you and the students?
2. What changes do they make in the classroom? Or do you notice any changes in the overall "feel" of the classroom?
7. Now that you know a little bit more about Healing Circles, would Healing Circles be something that you would want to implement in your Ethnic Studies course?
1. If you already engage with Healing Circle practices, which practices do you most often use and what changes do you notice?
8. Do you think that Healing Circles would align well with the material taught in an Ethnic Studies course? If yes, then why? If no, then why not?

Part 3 Questions for Students
1. If you are comfortable, please share the name of the institution you are currently in as well as your major, and how many Ethnic Studies courses you have taken.
2. What is the mind, body, spirit impact of learning about heavy concepts like, for example, racism, slavery, colonialism, oppression, in your Ethnic Studies classroom?
3. Do you remember what it was like to learn about histories of oppression in your Ethnic Studies course?
a. How did your mind, body, and spirit respond to the conversations and histories of oppression in your Ethnic Studies course?
5. Do you feel like there is a balance in what you learn in your Ethnic Studies courses? In other words are discussions of oppression and liberation discussed equally?
a. What have you experienced?
6. Have you ever felt a re-opening of trauma and/or a feeling of vulnerability in an Ethnic Studies course? If so, can you please tell me more about it?
a. Did these feelings linger after the course ended?

The interview is now complete.

Would you like to take another moment to reflect or relax your bodymind before we end?
We want to thank you for your honesty and vulnerability.

Findings

After collecting my data from my interviews and attending the Healing Circles, I have discovered three themes for my research. They are Institutional Violence, BodyMindSpirit reaction, and Needing to Heal.

For the first theme, it is Institutional violence. The theme of institutional violence is defined as the violence student deal within the academic institution, particularly BIPOC students and faculty. Both subjects deal with different set of traumas that the institution puts on them. This theme revealed itself when I conducted the semi-formal interviews.

In the interview, I asked the participants if they ever had a reopening of a trauma from an Ethnic Studies classroom and 9 out 9 participants all agreed that they did have a reopening of a trauma. To follow-up these questions, I asked if the feelings lingered after the course ended and they all said feelings this lingered. The difference was from the duration. Some students mentioned anywhere from weeks to months, to even present time they felt it. One quote from the participant was, "Yeah, definitely. I did feel that when I learned about the Dakota 38 plus 2 mass hanging. When I first heard about that it really opened a big wound like somebody who stabbed me in the heart, and I think every time like somebody talks about it. Even like talking about it now. kind of just opens it up a little wound." This quote comes from a Student #7 who identifies as Native American. It hits her more personal, since it is her own people who were murdered. It could have easily been one of her ancestors. Something the student mentioned that I really appreciated it was she pointed how there is never a "right time" to learn this. What she meant by it was that it's not like professors can plan this lesson out to be better absorb early morning or possibly it might be a better reaction in an afternoon class. Regardless of the time, this is something heavy for a student to learn about, but these stories need to be spoken and learned about. We need to shed a light to the harsh realities the native people have been treated with in the US. This supports my research question by highlighting that my question is valid. It demonstrates that this is a problem. Students need the support in Ethnic Studies classrooms from reopening of trauma. The student also agreed that Healing Circles would be a good option to incorporate into Ethnic Studies. As a Native student, she has grown up with part taking healing practices. She has not personally done a Healing Circle but is familiar with the concept. She has done a sweat lodge, which also has similar characteristics of a Healing Circle. She mentions that whenever she part takes into a healing practice, she always feels better afterwards.

As for the educators, they face a different type of institutional violence being professors. With their status, the type of violence they face is being overworked. They do not have a form of healing implemented into the institution. During the pandemic this issue was more prevalent. Many faculty felt that they were being spread too thin without any extra support. One of the professors mentioned how being a faculty of color, comes with its own set of issues that non- BIPOC professors don't deal with. He mentioned how he gets burnt out. "If you look at the history of higher ed, weren't historically created for people of color, for students of color. And that ties back to what we talked about earlier, is the need to overcompensate, to be overworked. I think is really kind of be, in my opinion, could be perceived as an act of violence which itself is traumatic, right?... Sometimes I feel compelled to always saying yes to students who need the support because I try to be that person that I

wish I had when I was in students.Well, when I was in college for my students. And that in itself the academic institutions are not created to support faculty." This narrative is also echoed in my literature review article of Reclaiming our Time. "Our scholarship, teaching, and activism are part of a larger collective struggle for social justice for those who are marginalized, silenced, and disempowered. We know that we cannot sustain ourselves if we are physically exhausted, emotionally drained, and spiritually dead." (Nicol & Yee, 2017). This quote serves as reminder that faculty need healing and selfcare. There needs to be systemic implementation of self-care support for BIPOC professors. If University wants to be more diverse in their faculty, they need to also consider the different support BIPOC professors are entitled to get.

The theoretical framework I am using to analyze for this theme is intersectional feminism. This framework solidifies the importance of having an intersectional framework. These students Identify as BIPOC and deal with complex issues in ethnic studies. Sometimes they deal with multiple forms of oppression and having an intersectional feminist perspective validates and sees them as whole. I had majority of women as participants as well. This framework best supports them and their multifaceted experiences in higher education. In addition, it also connects with what the types of institutional violence BIPOC faculty experience. They feel that must work twice as hard since academic institutions were not meant for people of color. These institutions were created to serve white colonist. Because of that, it is creating harm to our communities of color.

With the second theme, it is called the BodyMindSpirit reaction. This theme highlights how trauma can take different forms, and how it affects students differently in the body. This theme affected more the students than the faculty. I had a student mentioned how because of the Ethnic Studies class she had to go through therapy and get medical help as well. I asked her if she has a BodyMindSpirit reaction when learning about heavy topics, this is Student #6 response. "It's heavy, last semester at MT SAC... I was reading on trauma, and I couldn't, It was too heavy for to continue anything. I went to the doctor and I had to take time off from work; from life. looking at the consequences of these systems within my life. It just all hit me at once... it's kind of embarrassing that I usually have low blood pressure. I had a high blood pressure." This type of trauma manifested itself into giving her high blood pressure. She was not the only student who I interviewed that had a mental breakdown and had to reach out and get professional help. Something student echoed was that not everyone has the resources to get professional help. Student #4 mentioned something that many people addressed as well. Feelings of frustration and anger. "I'm talking about this I think that's like a frustrating feeling for knowing that it's still present (racism) that like the effects of it today. Just as for me it's like really frustrating like as much as I do like to learn about it. It almost feels like crippling like holding that knowledge and like not knowing how to like really to apply it, anywhere." These feelings linger inside students, and they do not have a healthy outlook to be able release from their BodyMindSpirit.

The framework to analyze this would be LatCrit. How identify as Latinx, culturally students and faculty are not equipped to take on the complexity of emotions when taking about heavy subjects. Both these students identified as Chicana/Latina and brought up how they were never taught to express complex issues. This supports my research question because students are being affected inside classrooms. It is having serious consequences.

From students needing to go to therapy to actual health issues. We need to do better and provide a healing component requirement. Classes should not be causing more harm to students. Healing Circles can be a culturally safe space that can allow students to release what they unpack in Ethnic Studies Classrooms.

The final theme is Needing to Heal. This theme is the resolution to the issue. There is clearly a problem of reopen traumas in classroom and this is a doable solution for it. All faculty agreed that Healing Circles would align with the Ethnic Studies curriculum. They all practice a form/framework of it but would be open to implementing it. Some of the issues that arise, are making sure they have adequate training and making sure the indigenous part of it in being respected. I asked the faculty if they thought Healing Circles would align with the material taught in Ethnic Studies and Faculty #5 brought a great perspective to push for Healing Circles. "Because in Ethnic studies you're inviting students to look at themselves and look at their own histories, and to better understand their own family history. And there can be a lot of pain and dysfunction in those histories. If you're in a healing circle where the perfect is to support each other and listen to each other, it will help to." She is someone who has been implementing healing components into her classroom. She mentioned to me how she would take her class outside or light up some palo santo when she discussed heavy topics to her class. Faculty #2 connected how Healing Circles would align directly into the curriculum of Ethnic Studies.

"I would love to do this type of work because I think it'd be powerful to not just leave it in as a practice, but also to connect it to the histories that made healing circles possible. This has indigenous roots to what communities. This is an example of colonialism. No eradicating specific practices and traditions. And it speaks to the resilience and just, you know, communal amazingness of, of indigenous communities in North America or elsewhere."

The framework to analyze this theme would be Ethnic Studies Pedagogy. Having professors push for healing into classroom settings is setting up students for success in every part of their lives. Having a caring academic environment for students is the future of Ethnic Studies.

With the Literature Review article, it shows how Healing Circles can be implemented to any culture and it would serve its purpose in healing students. It was used in for Black Women and their culturally facet issues they faced, and it provided them with the space of validating themselves and healing. "Bringing curriculum into a classroom that invites marginalized students to examine discuss and practice radical self-care and healing as part of a black feminist anti hegemonic project or resistance." (Richardson, 2018). This connects with my research question because it provides evidence of what solution-based problem can be fixed. If we want students and faculty to succeed, this type of transformative self-care needs to be a part of the curriculum. Faculty and students are in support, now we just need to institution to get on board as well.

Conclusion

In conclusion, this research has given me a sense of validation as a BIPOC student being an Ethnic Studies major. I always felt that the classes I took were missing a healing component and listening to other students made me feel less isolated. Students shouldn't feel jaded or numb when it comes to heavy topics in Ethnic Studies. It shouldn't be seen the norm of having to take on these reopening of traumas and letting it be your own baggage you must unpack by yourself. Self-care is community care. Ethnic Studies classrooms can provide that outlook space. My research has also taught me that BIPOC professors also dire need of self-care. They are aware of the heaviness of topics that they must teach, and they try their best to provide a framework of healing. All the professors are in support to push to have Healing Circles into the Curriculum.

Some gaps or pitfalls I faced was because of the pandemic, the original location I had set to go and participate in a Healing Circle was not doable. The WOC Collective space was closed during my entire time of working on my research due to not enough resources and safety of the community. I also had to conduct all my interviews remote. They were all done through Zoom, and I feel that if I had my interviews in person, it would have provided an extra sense of healing to my participants. The IRB process took longer than I anticipated. If I had submitted my application sooner, I would have been able to partake in more interviews. I want to continue this research in graduate school. I feel I only touched the surface level of this work. I can see the future of this work into other types of research studies. I would love to conduct an experiment where we have two Ethnic Studies classrooms, and one has a Healing Circle component, and the other does not and comparing the difference. I also would extend this to the community. Many community organizations are doing the Healing Circle work and they can be brought in to do Healing Circle trainings to professors and students.

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Soos   **The SPICY Milky Way: Evaluating the Reliability of an Inner**
Carly   **Galactic Plane YSO Catalog**

Introduction

Understanding the beginnings of our Solar System and how it came to be is a fascinating topic and one that astronomers are constantly studying. In this, astronomers observe young stellar objects similar to our Sun in stellar nurseries often located along our Galactic midplane as well as the planet-forming dust disks that frequently surround them. Currently, there is no convenient and comprehensive list of these young stars for astronomers to use in their research. By observing and analyzing the closest list we have, the SPICY Catalog, we will be one step closer to providing it for use.

Theory

Young stellar objects (YSOs) are baby stars or stars in the early stages of their evolution that are frequently hosts to infrared-emitting disks of dust that give rise to their characteristic color. The formation of these young stars begins when part of a cloud collapses into a central star with a dusty protoplanetary disk, eventually turning into a pre-main sequence star, and ending as a central star surrounded by a planetary system. We are able to identify these YSOs using either mid to near-infrared (IR) measurements which help identify the disks or by using X-ray measurements as the X-ray emission of YSOs peaks during their early evolution. These YSOs are typically found in dusty star-forming regions mostly located near the Galactic midplane. We are able to use infrared measurements to peer through this gas and dust in order to view our YSOs, but the data is affected by reddening and extinction. Interstellar reddening of lightwaves occurs when light from a distant star passes through dust or gas clouds. The shorter blue wavelengths are either absorbed or scattered by the dust or gas, making our telescopes measure a more red observation of the star's light. Interstellar gas and dust also produce extinction effects, which cause our sources to look dimmer due to the scattering and absorption of their light on its way from the star to our telescopes.

Background

As of now, there is no fully comprehensive list of YSOs for astronomers to use, however, the Spitzer IRAC Candidate YSO (SPICY) catalog is the most comprehensive list of young stellar objects compiled to date, containing ~120,000 objects. Using GLIMPSE (Galactic Legacy Impulse Mid-Plane Survey Extraordinaire) Spitzer data, SPICY identifies these YSOs using the mid to near-IR measurements of the Galactic midplane. The SPICY catalog does not include X-ray identified sources, or sources with weak infrared excess, which is why it is not comprehensive on its own.

In order to make a comprehensive list of YSOs, we must not only include the X-ray identified sources that SPICY does not recognize, but we must also find and remove any sources that the catalog mistakenly identifies as a YSO. The most likely contaminating sources in the catalog would be highly-reddened background giants.

These giants stars would be located far behind our source, but from our perspective, they seem to exist within the stellar nurseries we observe. Taking a closer look at each of the sources, we are able to understand that the light from these stars is actually being changed by the interstellar dust and gasses, with the light scattering and behind absorbed making the source appear redder and much dimmer than it actually is. Finding a way to identify and remove these contaminating sources is essential in creating a list of YSOs that is correct in its identification.

Methods

One way of observing the stars in the SPICY catalog is by using a color-color plot, or a plot that can display the color of an object depending on where it lies on the graph. On the plot used for this project, an object is redder as it moves up the y-axis and to the right, whereas it is bluer as it moves down and to the left. Interstellar reddening due to any foreground dust, such as any dust in the star-forning regions, will cause an object's y position to move on the plot. The x-axis has the effect of reddening from the presence of a dusty disk glowing in the infrared. On the plot, we notice there is an observed two-wing shape that looks similar to a butterfly. A valley cuts between the wings of the color-colot plot and is caused by it being populated mostly by normal older stars which have been removed from the SPICY data set as expected. The lower is where most of our SPICY-identified data points are located, representing YSOs, and as we approach the smaller upper wing, our points begin to include older stars mixing in with YSOs. The suspicious upper wing of this color-color plot is the focus of our analysis in order to separate true YSOs from any background contaminants. To ensure that points are located where they appear, we remove any sources with high uncertainties in their color measurements so as to not skew any analysis performed.

As we supplement our SPICY catalog sources with the Chandra/ACIS X-ray YSOs and overlay them on the color-color plot, we see that most of the X-ray sources reside in the upper wing. Because of these confirmed sources, we cannot simply throw away the entire upper wing, or else we will discard our bracket of X-ray YSOs. To further analyze this upper wing, we must look at the reddening of the sources.

In the color space used for the plot introduced above, a vector known as the reddening vector indicates that as a source is reddened on this plot, it moves up a one-to-one line on the plot. This reddening vector makes dereddening the data points simple, as we just move the highly reddened points in the upper wing down a one-to-one line until they reside in the lower wing. The change in a point's vertical or horizontal coordinate is what is called the excess in this specific color space. This excess is the measurement of how much each of the sources was reddened by interstellar reddening or by its infrared disk on our plot. Plotting these excess measurements in a histogram, we are able to see a gradual decline in the frequency of sources as the reddening excess increases until we reach an excess of around 1.5. At this measurement, we see a higher ratio of sources with more reddening in both of the star-forming nebulae observed. This leads to suspicions concerning how reddened the objects are. When observed further, the upper-wing sources above this color excess also show much higher magnitudes than those of the lower-wing sources, meaning that those in the upper wing are much dimmer than the similar sources

from the lower wing. These analyses guide us to believe that they are background red giant contaminants not located in our nebulae nor are they the baby stars we are searching for. Out of the 876 total sources measured by SPICY in both regions, there are 26 total sources above this cut of a 1.5 color excess measurement which are removed from the progress towards a comprehensive list.

Results and Conclusions

The upper wing of our color-color plot reveals a higher ratio of sources with a reddening excess above a threshold of 1.5 compared to the lower wing, representing an estimated three percent contamination rate in the SPICY catalog for these regions. To supplement this measurement, we must also examine mid-plane areas without massive star-forming regions, where the YSOs are more widely distributed. Finally, we construct a comprehensive membership list of ~1,600 sources for the Cat's Paw Nebula, including both SPICY and Chandra/Gaia-identified young stars and YSOs. We also construct a list of approximately ~1,200 sources for the Lobster Nebula including both X-ray and infrared observations.

**Tan   Synthesis of Novel Molecules from cis-Pinonic Acid as Potential
Tan   Therapeutic Agents**

ABSTRACT

Pinene structure contains a four-membered ring that has various interesting biological properties. This project focuses on synthesizing different novel molecules, starting by transforming α-pinene into cis-pinonic acid. We used different amines to produce derivatives of this acid. Further synthesis of new molecules and their application for potential therapeutic agents were also discussed, which may result in new hits for drug discovery.

INTRODUCTION

The development of organic synthesis from natural resources had evolved over time and allow humans to discover many molecules. Chemists play important roles in determining the strategies to synthesize these new structures using fragment identification, known compounds from the published literature, or structure-based drug design3 to achieve new hits in drug discovery. development.

Pinene is known for its contribution to "pine" scent of trees such as rosemary, or parsley. There two isomers belong to monoterpenes group that associated with preclinical pharmacological effects in many studies.7 α- and β-pinene have been used as a starting material for years to synthesize new compounds due to their availability and low cost. Oxygenated derivatives of pinenes have been proved for antibacterial and anti-inflammatory effects.9 The products of α-pinene have been used as antifungal and disinfectant and became prominent in pharmaceutical industry.5 The transformation to cis-pinonic acid can be achieved through the oxidation of α-pinene using oxidative reagents such as KMnO4, followed by the conversion of the functional groups with substituted amines to results in different α-pinene derivatives. Ultimately, the newly synthesized novel molecules will be screened to test for potential therapeutical effects.

RESULTS AND DISCUSSION

Oxidation of α-pinene: The procedure of α-pinene oxidation was referenced from Qian Song. et al's article, however, we used smaller scale to test for its efficiency. The mixture of α-pinene, ammonium sulfate, and potassium permanganate was stirred efficiently at low temperatures. The mixture was then filtered and acidified with concentrated sulfuric acid and addition of sodium thiosulfate (Figure 1). The solution was then extracted by ethyl ether and isolated to obtain a light yellow-brown oil (0.563 g, 40.4%) . Small amount of sample was taken for TLC, and the disappearance of α-pinene spot on the final product indicated the completion of the reaction.
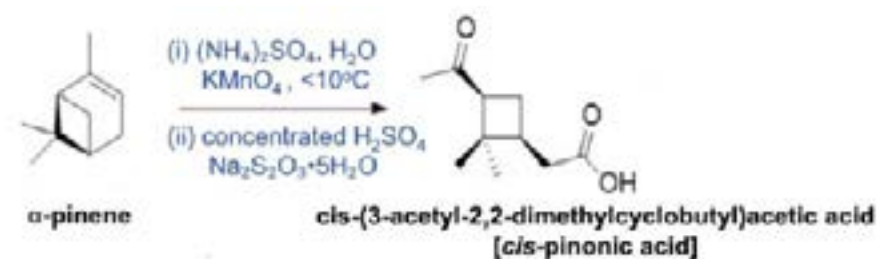
Figure 1. Oxidation of α-pinene

In the process of oxidation of α-pinene, the droplet addition of concentrated sulfuric acid did not turn the solution to yellow-brown color as mentioned by Qian Song. et al. Not until we added 1.0-1.5 g of Sodium thiosulfate with some more sulfuric acid droplets, did the solution immediately change from dark purple to colorless. The pH indicator turned red indicating that we had acidified the solution. After being extracted and isolated, the product was then identified by 1H NMR spectroscopy (CDCl3) δ: 2.89 (t, 1H, CH), 2.28-2.40 (m, 3H, CH & CH2), 2.03 (s, 3H, CH3), 1.90-1.98 (m, 2H, CH & CH), 1.32 (s, 3H, CH3), 0.88 (s, 3H, CH3). (Figure 2). It can be indicated that our spectral data are consistent with the literature report from Fernández et al.1
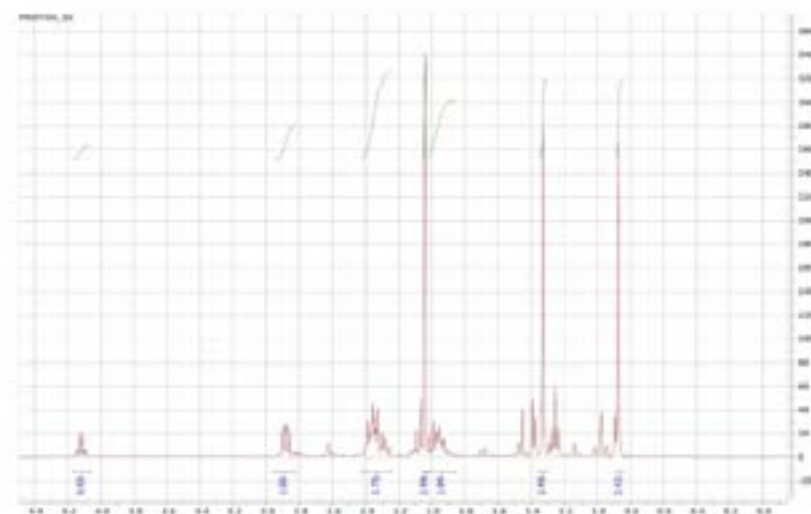
Figure 2. 1H NMR Spectra of cis-Pinonic acid

Transformation of cis-Pinonic acid using substituted amines

In the process of transforming cis-Pinonic acid into the derivatives, Oxalyl Chloride (COCl2) was used to react with the carboxylic acid group in cis-Pinonic acid to afford the acyl chloride. Therefore, solution turns white/yellow foamy with bubbles formed, indicating the formation of carbon dioxide gas. The solution was then kept stirring for at least 2 hours before adding the substituted amine. In separate experiments, the 1o amine from Benzylamine and Thiophene-2-ethylamine perform nucleophilic attack, deprotonation, and Cl- expel to obtain our goal products 1a and 1b, respectively (Figure 3).
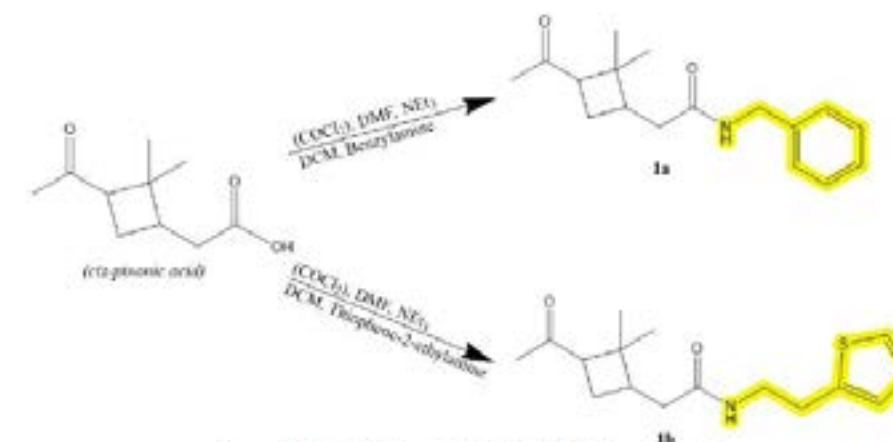
Figure 3. Reaction Scheme for cis-Pinonic Acid transformation.

Product (1a) of cis-Pinonic acid and Benzylamine was isolated after being recrystallized has light-yellow oil (0.1488 g, 49.87%). The percentage yield could be higher as we lost some sample from the NMR tube. 1H NMR spectroscopy (CDCl3) δ: 7.2-7.4 (m, 5H, C=CH), 5.7 (s, 1H, NH), 4.43 (d, 2H, CH2), 2.89 (m, 1H, CH), 2.24-2.55 (m, 4H, CH), 2.11-2.14 (m, 1H, CH) 2.04 (s, 3H, CH3), 1.33 (s, 3H, CH3), 0.86 (s, 3H, CH3). (Figure 4).
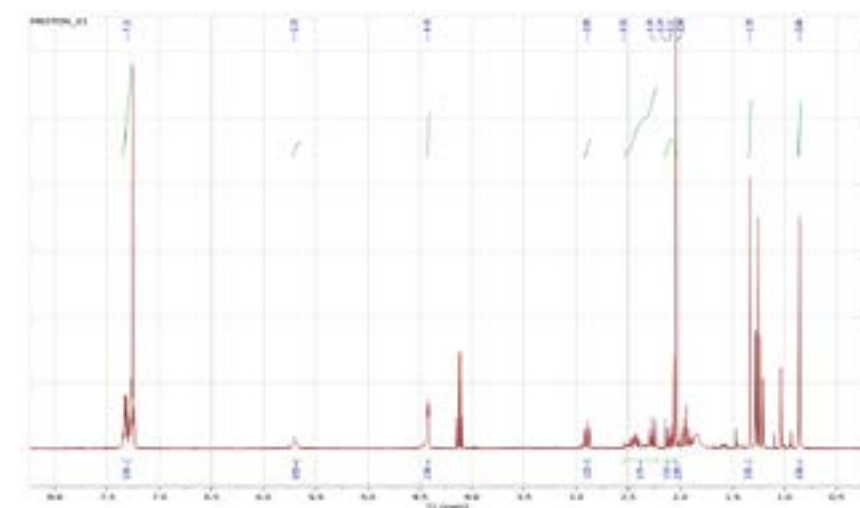
Figure 4. 1H NMR Spectra 1a

(1b) After being purified using CombiFlash Chromatography, the crude product of cis-Pinonic acid and Thiophene-2-ethylamine was obtained as dark yellow/orange oil (0.134 g, 58.0%). It was then identified using 1H NMR spectroscopy. However, there were still several impurities/ extraneous peaks in the NMR spectrum. Preparative TLC was used to increase the purity of the product, giving the percent recovery to be 72.4%. The purified sample was taken for another 1H NMR (CDCl3) δ: 7.17 (d, 1H, CH), 6.95 (t, 1H, CH), 6.83 (s, 1H, CH), 5.52 (s, 1H, NH), 3.0-3.5 (m, 6H, CH, CH, CH2, CH2), 2.2-2.5 (m, 4H, CH2 & CH2) 2.03 (s, 3H, CH3), 1.31 (s, 3H, CH3), 0.83 (s, 3H, CH3). (Figure 5).
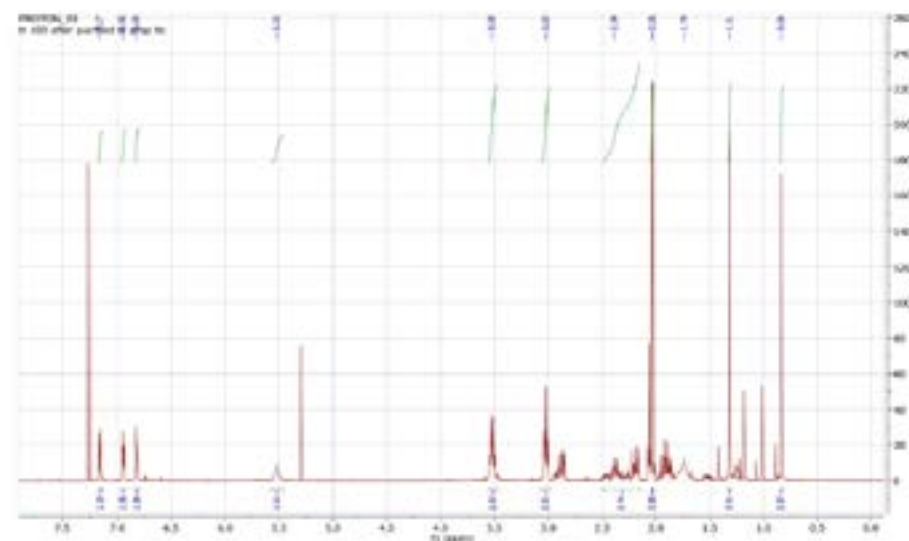
Figure 5. 1H NMR Spectra 1b

EXPERIMENTAL

Materials

Chemicals used for this research were obtained from commercial suppliers and used as received, including Potassium Permanganate, Ammonium Sulfate, Sodium Thiosulfate, Sulfuric acid, and α-pinene provided by Department of Chemistry and Biochemistry stockroom. The transformation into derivatives includes Benzylamine, Thiophene-2-ethylamine, Oxalyl Chloride, Dimethylformamide, Triethylamine. Dichloromethane is used as general solvent, and ethyl acetate and hexane for column chromatography, along with TLC silica gel plates.

Instrumentation

Instruments required for analysis includes Varian 400MHz NMR Spectrometer, Teledyne Isco CombiFlash NextGen 300 chromatography apparatus, UV Lamp, Buchi-1 Rotary evaporator, hot plate stirrer and analytical balance. The chemical structures and their molecular weights were obtained using ChemDraw 21.0.0, and MestReNoVa x64 program was used for 1H NMR spectra analysis.

Procedure

Oxidation of α-pinene: α-pinene (1.20 mL, 7.34 mmol, 1 equiv.) was mixed with Ammonium Sulfate (0.506 g, 3.82 mmol, 0.5 equiv.), and Water (10 mL) in a 25 mL round bottom flask. The temperature is kept under 10oC using ice bath. While the solution was stirred using hot plate stirrer, add Potassium Permanganate (2.655 g, 16.8 mmol, 2.3 equiv.) gradually for 10 minutes. The flask was stored in fridge for 48 hours. The manganese oxide byproduct was removed using filtration with addition of water to wash the precipitate. Concentrated sulfuric acid was used to acidify the filtrate, followed by the addition of Sodium Thiosulfate (1.0-1.5 g). The solution was then extracted with ethyl ether (3 x 20 mL) and transferred to a vial using acetone, followed by Rotatovap to isolate the solution.

Transformation of cis-pinonic acid using Benzylamine: cis-Pinonic acid (0.204 g, 1.08 mmol, 1.3 equiv.) was dissolved in Dichloromethane (10.8 mL) in a 50 mL round bottom flask with stirring at room temperature. Oxalyl chloride (0.090 mL, 1.0 mmol, 1.2 equiv.) was added directly into the flask, followed by Dimethylformamide (6 drops). The mixture was stirred for 2 hour. Benzylamine (0.10 mL, 0.83 mmol, 1 equiv.), and Triethylamine (0.115 mL) were added into the RBF and solution was continuously stirred for 2 days. The mixture was then washed with saturated Sodium Bicarbonate (3 x 20 mL), followed by Brine (2 x 20 mL) before being dried with Sodium Sulfate Anhydrous (2 scoops). The mixture was then transferred to a 100 mL round bottom flask and purified again using CombiFlash Chromatography.

Transformation of cis-pinonic acid using Thiophene-2-ethylamine: Using the same procedure as above, cis-Pinonic acid (0.201 g, 1.08 mmol, 1.3 equiv.) was dissolved in Dichloromethane (10.9 mL) in a 50 mL round bottom flask with stirring at room temperature. Oxalyl chloride (0.090 mL, 1.0 mmol, 1.2 equiv.) was added directly into the flask, followed by Dimethylformamide (6 drops). The mixture was stirred for 2 hour. Thiophene-2-ethylamine (0.10 mL, 0.83 mmol, 1.0 equiv.), and Triethylamine (0.120 mL) were added into the RBF and the solution was continuously stirred for 1 days. The mixture was then washed with saturated Sodium Bicarbonate (3 x 20 mL), followed by Brine (2 x 20 mL) before being dried with Sodium Sulfate Anhydrous (2 scoops). The mixture was then transferred to a 100 mL round bottom flask and purified again using CombiFlash Chromatography. After being analyzed under 1H NMR, Prep TLC chromatography was used to further purify, using DCM as the chamber solvent. The main band on the prep TLC plate was scratched and collected through filtration using Acetone (50 mL).

CONCLUSIONS AND FUTURE DIRECTIONS

In conclusion, the oxidation of α-pinene procedure to cis-Pinonic acid using potassium permanganate catalyst has been successfully carried out as referred from literature review, producing a yellow-brown oil with fair yield. The additional usage of sodium thiosulfate, which was not mentioned in the literature, helped convert the color of the solution. The formation of cis-Pinonic acid was confirmed using 1H NMR spectra. Moreover, the transformations of cis-Pinonic acid to two novel amide derivatives using two different substituted amines was also achieved with yields ranging from 50-58% and identified by 1H NMR spectra . The purity of the (1b) product was improved successfully using Prep TLC.

Since the usage of small scale of starting materials did not lead to high yield of cis-Pinonic acid, in the future laboratory, we want to improve the yield by using larger scale (~10 mL of alpha-pinene) or different oxidation conditions to improve the efficiency of formation of cis-pinonic acid and minimized waste. The amount of the oxidant KMnO4 and stirring time also needed to be modified in order to prevent potential decomposition of this product.

Additionally, more complex substituted amines could be utilized to transform the acyl chloride part of the cis-Pinonic acid to novel molecules containing amide group. The ketone functional group on cis-Pinonic acid could be transformed to alkene using Wittig reactions or Schiff base using primary amine under mild acidic conditions. We would also use our final

synthesized novel molecules to collaborate with Biological Laboratory to test for potential therapeutical effects.

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Recognition of Roadway Sign at Night Using Thermal Imaging and Computer Vision

Abstract

As a novel approach based on spatial heat patterns, thermal imaging is less impacted by unfavorable environmental conditions such as night, fog, or rain compared to many other types of sensors. Despite the wide range of applications, thermal imaging has seen rare applications in nighttime road sign recognition, which is crucial for various levels of driver assistance systems. To this end, the study applied a set of Mask R-CNN detection models to classify various types of roadway signs collected from California communities at night. Albeit with some limitations such as a small sample size for specific sign types and the low-resolution images, the results demonstrate the great potential of employing thermal imaging to efficiently recognize signs at night, with high levels of accuracy for large objects and rapid process that allows for the real-time prediction. Overall, model schemes seem to have a statistically significant influence on the inference speed and illustrate a moderately significant association with the total loss. Conversely, backbone types are not highly correlated with sign recognition performance. Bounding box generation tends to yield better performance compared to the instance segmentation due in part to the easier task associated with the former process. Further research is highly recommended for the important sign recognition using thermal imaging.

INTRODUCTION

Roadway signs serve to provide crucial information to drivers that will ensure safer driving conditions. For this reason, roadway signs are often made in a variety of different shapes and sizes to help differentiate between one another [1]. To further ensure roadway sign visibility, several methods have been implemented, including sign placement [2], use of reflective material [3], and providing adequate lighting [4], to name a few. Despite the long-established use of these signs and methods to increase visibility, the design, placement, and lighting accommodations do not guarantee perfect safe driving conditions [5]. Many accidents are speculated to have been caused by the driver failing to notice roadway signs or recognize them [6]. This issue arises most in less-than-ideal conditions such as those caused by nighttime drive in the form of headlight blinding [7] or general low-light levels [8]. Other environmental factors that could contribute to drivers' inability to notice roadway signs include rain, snow, and fog [9]. These situations significantly compromise the driver's visibility and hinder their ability to drive safely. One seemingly promising solution to the issues is the use of various levels of driver assistance systems culminating in autonomous vehicles.

Autonomous vehicles can sense and interpret their environment to traverse safely with little to no human input [10]. Beginning development in the late 1920s [11], autonomous vehicles have undergone many improvements parallel to the advancements of technology, including sensors to interpret its environment [12], communications between one vehicle to another [13], as well as software programmability such as Computer Vision (CV) [14, 15], to name a few.

One type of sensor that autonomous vehicles use to interpret their environments is Light Detection and Ranging (LiDAR). LiDAR uses an infrared laser to image an object. This laser is deflected from the object and the time it takes for the light to return to the LiDAR device is measured and used to calculate the distance between the LiDAR device and the object in question [16]. This measurement is helpful as it allows autonomous vehicles to accurately determine their position in the environment [17]. LiDAR, when coupled with CV, permits autonomous vehicles to track their trajectory by identifying crucial objects near or on the roadway [18]. Unfortunately, LiDAR systems are prone to producing errors in less-than-ideal weather conditions such as dense fog, dust, rain, snow, and low-light levels [19]. In addition, the cost of a LiDAR system for an autonomous vehicle far outweighs the benefit, as a complete LiDAR system for a single-vehicle can easily cost upwards of $70,000 nowadays [20, 21]. A more cost-efficient method of determining where a vehicle is in respect to its environment uses more traditional cameras in stereo vision. Stereo vision is a system that utilizes multiple cameras to provide a slight offset to objects in focus to determine the distance to the object [22]. When stereo vision is coupled with CV, the system can be used for obstacle avoidance and distance measurements in vehicles and will play a crucial role in autonomous vehicles [23]. Similar to LiDAR, it is still difficult for stereo video to identify objects in low-light levels. Fortunately, night vision or infrared vision could provide clearer images/video in low-light levels, and in some cases, no-light levels [24]. Hence, when stereo vision is implemented with night vision and CV, autonomous vehicles can detect objects in specific less-than-ideal conditions [25]. Despite these benefits, there are still issues with the upgraded stereo vision for detecting objects. Night vision needs some visible light to work properly as they only amplify the light levels present. In addition, night vision is often impaired by dust, smoke, rain, and fog. Yet, thermal imaging is another solution to these issues, which is not affected by the conditions that plague night vision [26].

Thermal imaging, unlike night vision, does not rely on light levels but instead takes measurements based on temperature [27]. Due to this special property of thermal imaging, any particle that could reflect light (i.e., fog, rain, snow, dust) does not appear or affect the quality of the image or video, thus allowing for thermal imaging to have more detailed results [28] at night or other inclement weather conditions. No wonder thermal imaging has seen its use in a wide variety of applications such as wildlife tracking [29], arterial pulse tracking in the human body [30], elderly fall detection in nursing centers [31], and stadium occupancy detection [32]. In addition, due to the promise thermal imaging offers, it, especially when coupled with CV, has been utilized within autonomous vehicles in pedestrian detection [33, 34], vehicle detection [35], and wildlife detection on the roadway [36]. However, even though a large amount of literature highlights the benefits and applications of thermal imaging and CV in detecting crucial points of interest from a vehicle perspective, little effort has been made to detect roadway signs using thermal imaging with CV. So far, most of the studies related to roadways signs revolve around normal cameras taking photos during the daytime.

Much like the extensive studies focusing on thermal imaging in different fields, many studies have also been dedicated to CV. CV is a field of study that seeks to develop methods to allow computers to "see" and comprehend information presented by digital images and videos [37]. Since its advent in the 1960s [38], CV has undergone many improvements using various methodologies. Such CV methods include statistical modeling, such as Active Appearance Models and Active Shape Models [39], decision-tree

algorithms that include minimum spanning trees [40] and dual-tree [41], and more recently, neural networking models like Artificial Neural Networking [42], Backpropagation Neural Networking [43], and Convolutional Neural Networking (CNN) [44]. To improve CNN's capabilities in object detection, Region-based Convolutional Neural Networking (R-CNN) has been developed. R-CNN organizes each object within an image into a Region of Interest (ROI), after which a set of support vector machine classifiers to determine the class of object within each ROI. Fast R-CNN and Faster R-CNN have been developed to reduce the computation time of R-CNN by implementing ROIPooling to isolate objects prior to classification [45, 46]. Subsequently, more advanced object detection methods were proposed. One unique methodology is known as You Only Look Once (YOLO). YOLO is a real-time multi-object detection algorithm that utilizes a single convolutional network for object detection over the entire image [47]. YOLO identifies objects within an image by first organizing the image into a grid. After that, the image is passed through a neural network to generate bounding boxes and object class predictions. Since these bounding boxes often overlap, YOLO implements an Intersection over Union and Non-maximum suppression processes following the initial bounding box generation. This procedure permits YOLO to identify objects with remarkable accuracy [48]. Since its advent, YOLO has been updated to YOLOv4 to improve overall speed and accuracy by refining its previous versions [49]. YOLOv4 has been widely applied, such as the detection of red foxes [50], flower ends [51], road stress [52], vehicle [53], roadway sign [54], as well as object detection using thermal imaging [55]. Another sophisticated method, Mask R-CNN, was developed to improve overall accuracy soon after the development of R-CNN [56]. As a recent technique, based on these systems, since its recent invention, Mask R-CNN has seen its quick use in a variety of different applications such as cattle tracking [57], building identification from satellite images [58], identification and classification of breast tumors [59] and oral diseases [60], and many more. A scrutiny of studies approached Mask R-CNN in the field of transportation as well. A study conducted by Nafi'i [61] sought to use Mask R-CNN for vehicle brand and type detection. Another study done by Lin & Li [62] utilized Mask R-CNN for license plate recognition. Although there are various benefits related to Mask R-CNN, its applications in roadway sign detection [63] and thermal image analysis in transportation [64] are limited.

The above literature review reveals the need to explore the capability of Mask R-CNN in recognizing roadway signs using thermal imaging. This study aims to address this demand by applying Mask R-CNN to identify traditional roadway signs using thermal images collected from multiple communities in California at night. Multiple models were implemented via the Detectron2 framework. The set of average precision (AP) scores for both bounding boxes and segmentation masks methods were obtained for disparate road signs. Further statistical analysis was performed for correlation exploration of various performance indexes.

DATA DESCRIPTION

Study Area and Data Collection

The study areas are located in multiple communities from four cities in Southern California which include San Marino (latitude: 34° 07' 44.56" N, longitude: 118° 06' 52.29" W), West Covina (latitude: 34° 04' 07.04" N, longitude: 117° 56' 20.22" W), Walnut (latitude: 34° 01' 13.04" N, longitude: 117° 51' 55.23" W), and Pomona (latitude: 34° 03' 18.37" N, longitude: 117° 44' 59.97" W). The data collection was performed at night on July 6th, July 7th, and July 11th, 2021. On July 6, 2021, 190 images were obtained in the city of San Marino. On July 7, 2021, additional 267 images were taken from the city of West Covina. On July 11, 2021, the last cohort of 586 images were collected from Walnut and Pomona, respectively. All the data collection was performed using a FLIR C3 thermal camera with 80 x 60 resolution. The photos were taken about 1.2 meters above the ground level at an oblique angle facing towards the road sign at night from 8:30 PM PDT to 11:50 PM PDT. The whole collection activity took around 20 hours in total, with a total of 1043 thermal images and 1043 non-thermal companions. Both thermal and non-thermal images were taken at the same time, for the same location, in order to provide a clear comparison and verification as well. Fig. 1 shows an example of one thermal image and its non-thermal counterpart.

Data Annotation

For model-training purposes, the thermal imagery of the road sign dataset was annotated using an open-source tool: VIA Annotation Software. VIA Annotation Software is a lightweight, standalone web application annotation tool developed by a group of scholars [65]. It is noteworthy that the partially displayed instances are still annotated with the portions visible in that frame of the image during the annotation process. Two annotated thermal image samples using VIA are shown in Fig. 2.

Data Statistics

In summary, there are 1043 thermal images with a resolution of [80 x 60]. On average, there are approximately two instances of road signs per image for the dataset, with the lowest and highest number of signs per image being 1 and 6, respectively. To illustrate the model capability, six categories of signs were included in the study: Stop Sign, Yield Sign, School Zone Sign, Street Name Sign, Speed Limit Sign, and Other Signs.
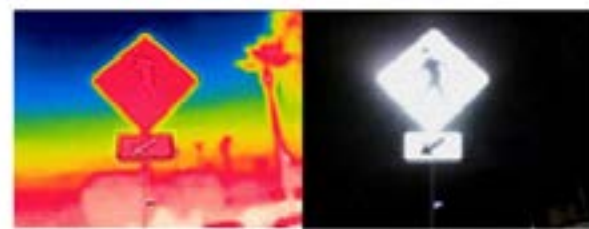

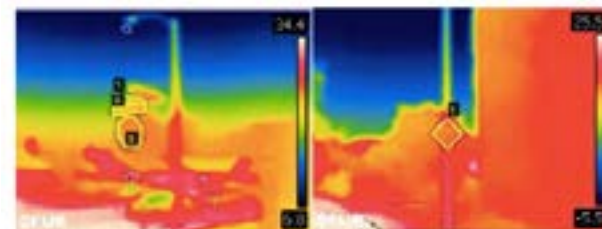Fig. 1.   Sample Thermal and Non-Thermal Image collected by FLIR C3 Camera

Fig. 2.   Annotation of Thermal Image Samples Using VGG Image Annotator

METHODOLOGY

Infrared Thermal Imaging

For ordinary optical cameras, images can neither capture the objects nor reflect the internal features of them under unfavorable environmental conditions such as night, fog, or rain. By contrast, thermal imaging [66] is a novel approach based on the spatial heat patterns (or, temperature field distribution) on the object's surface. In unfavorable environmental conditions such as night, fog, or rain, infrared thermography allows deep learning algorithms to detect objects more effectively and efficiently as richer information input information is given. However, it is noteworthy that thermal imagery is still displayed as 2D visual input. Hence, the training process to detect road signs on the thermal dataset using Mask RCNN is similar to that of a normal optical camera. Additionally, road signs vary in terms of shapes and the materials utilized to make them. Thus, the heat dissipation pattern of different signs would be unique, enabling the nighttime sign recognition by thermal imaging to be efficient.

Mask R-CNN

In recent years, deep learning techniques have achieved state-of-the-art results for many objects detection tasks on standard benchmarks and even surpassed human-level in some fields. Out of many CV methods, Mask R-CNN outperformed others on the COCO object detection challenge, which was introduced as an extension to Faster R-CNN with a more accurate pixel-level segmentation. In this study, the road sign thermal dataset is trained using the COCO instance segmentation Mask R-CNN models implemented in the Detectron2 framework. Compared to Faster R-CNN, the updated architecture features the usage of Feature Pyramid Network (FPN), support of mask segmentation, and the replacement of ROI Pooling layer with ROIAlign. Overall, Mask R-CNN consists of two main stages. During the first stage, the pre-trained backbone neural network extracts features and corresponding features map from the input image and generates the region of interests (ROI) containing an object. In the second stage, these multi-level feature maps and proposals will be forwarded to the ROIAlign layer to be refined into the bounding box and retrieve the pixel segmentation. Overall, Mask R-CNN's prediction and training process is illustrated in Fig. 3.
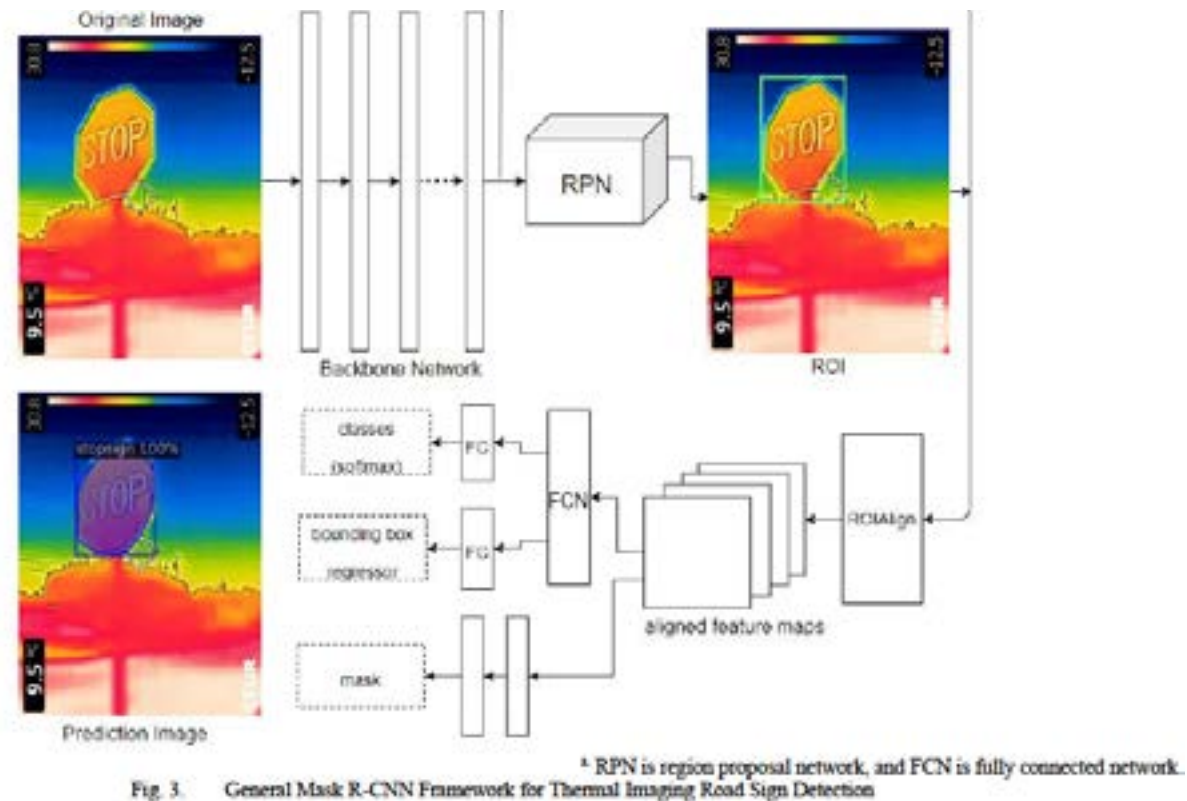
Fig. 3.   General Mask R-CNN Framework for Thermal Imaging Road Sign Detection

ᵃ RPN is region proposal network, and FCN is fully connected network.

Backbone Model

Base Network

The base network is simply a standard convolutional neural network as the feature extractor. Yet, as the network becomes deeper, the network suffers from the vanishing gradient and degradation problems. In other words, deep models' performance result saturates as the network already learned everything before reaching the final layers of the deep network; the performance result might even degrade rapidly. Yet, the convergence speed and object detection ability vary on the depth of the backbone model. Therefore, the research considers three variations of the residual network: ResNet-50 (R-50), ResNet-101 (R-101) and ResNeXt (X-101). Both R50 and R-101 consist of five stages. The input stage consists of a basic stem block consisting of one convolutional layer followed by the batch normalization, a ReLU activation function, and a max-pooling layer to generate the feature maps. Stages 2 to 5 include a set of convolutional blocks and identity blocks. Instead of having 5 convolutional blocks in stage 4 of ResNet-50, the ResNet-50 base network has 22 blocks. Thus, R-50 has 50 layers, and R-101 has 101 layers in total. X-101 architecture improves the original residual networks like R-50 or R-101 by introducing an additional dimension, which is also known as cardinality. ResNext expands the next dimension by splitting, transforming, and aggregating with the transformation F(x) as defined in Equation (1).

$$F(x) = \sum_{i=1}^{C} T_i(x)$$

Where $T\_i(x)$ is any arbitrary function, and C is the cardinality? Generally, ResNeXt solely slice the original input space into lower-dimensional representation embeddings, which will then be transformed with an arbitrary function T_i. The result of these subspaces will be subsequently aggregated using summation. Overall, the parameter complexity of the building block for R-101 and X-101 still remains the same. Yet, it is believed that the introduction of cardinality allows these residual models to refine to the new tasks more effectively and efficiently.

FPN, C4, and DC5

Feature Pyramid Network (FPN) structure is also adopted into the backbone of the Mask R-CNN model to improve the quality of the feature extraction process. Unlike the simple convolutional layer, the FPN in Mask R-CNN's backbone models is able to extract feature maps at different receptive fields to retrieve more in-depth and informative multi-scale features from the input image. Therefore, FPN allows the models to greatly improve the detection performance, especially for small objects, without requiring extensive computation while maintaining excellent accuracy and inference speed. Moreover, the backbone model incorporating the FPN can detect more objects (especially smaller ones) compared to other deep learning algorithms since the shallow features can distinguish the large objects, while the deep features of the FPN can recognize small targets. Detectron2 also supports two experimental backbone model schemes: C4 and DC5. C4 is the original baseline model proposed in the Faster R-CNN paper, where it uses a ResNet conv4 backbone with a conv5 head. Meanwhile, dilated-C5 (DC5) is introduced in the Deformable ConvNet paper [67], which adopts a ResNet conv5 backbone with dilations in conv5, a standard convolutional layer, and fully connected heads for mask and bounding box prediction, respectively. Overall, seven Mask R-CNN models were selected for road sign detection purposes that combine various combinations of the 3 backbones (or R-50, R-101, and X-101) and 3 schemes (FPN, C4, and DC5). For all 7 models, the training schedule 3x was employed, meaning 1 iteration per 3x12 (36) epochs. The full list of the 7 models can be found in Table II.

RPN Stage

The output of the backbone model is multi-scale feature maps, which will be forwarded as input into the region proposal network (RPN) – an equivalent version of the sliding-window detector. RPN is responsible for extracting the region of interests at different levels corresponding to the multi-scale of the feature pyramid network based on the size of the target object. These ROIs are then scanned individually and classified depending on whether the object is present within the proposed region or not. RPN generates a large number of anchors with different sizes and aspect ratios for a suggested region area. The network will generate a set number of proposal anchors based on their objectness score. The region proposal network refines these anchors into the bounding box while dividing these boxes into either foreground or background category, which reduces the computation underlying as the model only produces less yet high-quality ROI. As a result, the efficiency of the model will be increased. Meanwhile, the four coordinates of these boxes are regressed from the network. The non-maximum suppression (NMS) algorithm removes the invalid boxes with any of the four coordinates outside the image boundaries and those

overlapping ones (usually, the RPN NMS threshold is 0.7 by default). Thus, RPN eventually leaves about 2000 proposed regions of interest.

ROIAlign

As regions of interest are not aligned with the original grid of feature maps, the original pooling method from Faster RCNN introduces a lot of quantization operations to map the generated proposals to get integer x and y coordinate these indexes cannot have floating value. Therefore, misalignment between ROI and extracted feature maps makes the model lose a lot of useful data information, leading to lower performance. Although this imprecision might not adversely impact the classification and detection task, it has a large negative effect on the classification task on the pixel level when generating an accurate segmentation mask. Therefore, Mask R-CNN incorporates the new pooling operation, also known as ROIAlign, which mainly differs from ROI Pooling in the quantization stage of the pooling process. Specifically, ROIAlign utilizes bilinear interpolation to compute the exact values of the input features at 4 sampled points and aggregate the result using max or average operation, allowing the preservation of spatial information on the feature map, which solves the problems with regional mismatch and harsh and imprecise quantization resulting from ROI Pooling layer.

Loss Function

Mask R-CNN is trained on a multi-task loss function that combines the loss of classification task, localization task, and segmentation task, which is illustrated in Equation (2):

$$L = L_{cls} + L_{box} + L_{mask}$$

Where L_cls and L_box is the classification and bounding box loss, respectively, as defined in Faster R-CNN. Instance mask segmentation loss L_mask is introduced in Mask R-CNN, which only includes those positive instances. In other words, those instances with an Intersection of Union (IoU) value higher than the preset threshold value will be counted in the loss calculation. The additional average binary cross-entropy mask loss L_mask is defined in Equation (3):

$$L_{mask} = -\frac{1}{m^2} \sum_{1 \le i, j \le m} [y_{ij} \log(\hat{y}_{ij}^k) + (1 - y_{ij}) \cdot \log(1 - \hat{y}_{ij}^k)]$$

Where y_{ij} and $\hat{y}_{ij}^k$ are the label of the true mask and the predicted label, respectively, for the pixel at position i, j in the mask region of dimension m x m associated with the ground truth class k.

Training

Hyper-parameters Setup

High performance computing cluster was utilized for training all variations of backbone models. Each model was trained on a single node with 2 NVIDIA Tesla P100 graphics cards and 64 GB memory, allowing the models to load 10 images per batch per GPU during the training process. Mask R-CNN requires a large amount of annotated data for training in order to avoid overfitting. To overcome the problem of the limited annotated dataset in the present research, all 7 selected Mask R-CNN models were initialized with the pre-trained weights of the same architecture on the MS-COCO dataset, which were then fine-tuned for the road sign detection task. In addition, some additional hyper-parameters were modified in order to best suit the thermal dataset. The details of the important hyperparameters are presented in Table I.

Table I. Summary of Important Hyperparameters in Detectron2 for Road Sign Detection Task

Hyper-parameter name	Detectron2's parameter name	Value
Warmup iteration	cfg.SOLVER.WARMUP_ITERS	2000
Base learning rate	cfg.SOLVER.BASE_LR	0.001
Training iteration	cfg.SOLVER.MAX_ITER	20000
Checkpoint period	cfg.SOLVER.CHECKPOINT_PERIOD	10000
Number of classes	cfg.MODEL.ROI_HEADS.NUM_CLASSES	6
Batch size per image	cfg.MODEL.ROI_HEADS.BATCH_SIZE_PER_IMAGE	128
Anchor sizes	cfg.MODEL.ANCHOR_GENERATOR.SIZES	(8,16,32,64,128)
Anchor aspect ratio	cfg.MODEL.ANCHOR_GENERATOR.ASPECT_RATIOS	(0.5, 1.0, 2.0)
Input image's width	cfg.INPUT.MIN_SIZE_TRAIN, cfg.INPUT.MIN_SIZE_TEST	240
Input image's height	cfg.INPUT.MAX_SIZE_TRAIN, cfg.INPUT.MAX_SIZE_TEST	320

The input thermal image is also relatively small. Therefore, the input image does not need any scaling to preserve as much information as possible. In addition, to better cover more road sign areas in RPN, the sizes of the anchor point were adjusted to [8 x 8, 16 x 16, 32 x 32, 64 x 64, 128 x 128] and the aspect ratio was modified into [1:2, 1:1, 2:1]. The IoU value between the predicted box with the real bounding box utilized in RPN is equal to the intersection area of the two boxes divided by the union area of them, which was set to 0.5 in this research. When the value of the corresponding area of the anchor box area and the real target object area is greater than 0.5, the anchor box was then determined as the foreground. On the other hand, if this overlapping ratio is less than 0.5, the corresponding box was classified as the background and would be discarded. Moreover, the original models were pre-trained on the COCO dataset, which has 81 classes, so the number of categories needs to be modified into 6 instead of 81 by default since 6 classes of signed were considered. Warmup iteration was also applied to the models so that Mask R-CNN variations can slowly update the weights during initial nth iterations with the rate of. Finally, all models trained on the thermal dataset with 20,000 iterations and saved the checkpoint every 10,000 iterations.

Data Augmentation

The researchers implemented different augmentation methods such as horizontal flip, vertical flip, image rotation, and image translation to make the training data to be diverse and more representative.

Performance Evaluation Criteria

Recall and Precision

The evaluation of the typical object classification is usually based on recall and precision, which are defined as follows:

$$precision\ (p) = \frac{TP}{TP+FP}$$

$$recall\ (r) = \frac{TP}{TP+FN}$$

Where, TP represents the number of correctly classified signs, FP is the number of misclassifications of other signs into the concerned type, FN is the number of misclassifications of the concerned sign type into others.

Overall, the above two measures indicate the model performance from different perspectives. Precision measures how accurate is the model predictions of sign types, while recall indicates how good the model is at finding all the correct sign types.

AP Score

To determine the efficiency of each of the seven Mask R-CNN models in this study, the average precision (AP) score was utilized, which is a popular metric in measuring the accuracy of object detectors. Upon calculation of precision and recall, the AP score can be expressed as in Equation 6:

$$AP = \int_0^1 p(r)dr$$

here p(r) is the precision-recall curve drawn based on various pairs of precision and recall. In other words, AP can be defined as the area under the precision-recall curve. Since precision and recall values fall within the range of 0 and 1, the AP score also gets a value within the same range. The larger the AP score, the better the model classifies the road sign types.

Given the selected signs vary in sizes and AP scores are dependent on the IoU thresholds, the following types of AP scores were employed:
• AP: The average precision at IoU ranging from 0.5 to o.95, with the increment of 0.05.
• AP50: The AP score at the single IoU threshold of 0.50.
• AP75: The AP score at the single IoU threshold of 0.75.
• APs: The AP score for small sign whose area is less than 322 pixels.
• APm: The AP score for medium sign whose area is between 322 and 962 pixels.

• API: The AP score for large sign whose area is greater than 962 pixels.
To comprehensively compare the model performance, all above AP scores were calculated for the bounding box, segmentation mask, and each of the six categories of thermal road signs.

RESULTS

Inference

Table II shows the average time to classify road signs per image for the different models with various combinations of backbone and schemes. The average inference speed ranges from 0.06 to 0.36 second/image, which shall be fast enough for real-time prediction under normal driving conditions. One example of a predicted sign with ROI and associated confidence level is shown in Fig. 3 for illustration purposes.

Performance Evaluation

As mentioned previously, seven detection models consisting of different backbones and schemes were applied to the nighttime road signs captured by FLIR C3 thermal camera. For a comprehensive assessment, various AP scores are reported in Table II, along with other measures such as total loss, average inference speed, which also allow a better understanding of the relationships among the set of performance indices.

It is known from Table II that multiple models claim to perform the best under at least one evaluation criterion. The phenomenon indicates that the models have strengths and weaknesses from distinctive perspectives. Comparatively speaking, R_101_DC5_3x and R_50_C4_3x perform about the same, both of which outperform others in 12 and 11 different cases, respectively. X_101_FPN_3x claims first place in classifying the school signs. For the measures unrelated to AP scores, R_50_FPN_3x and R_101_FPN_3x appear to be superior to others in terms of the average inference speed R_101_C4_3x generates the least loss value. Given that distinctive models are ranked first place under the different conditions, it is recommended to explore various models first in the future before the final model of preference is determined.

Another remarkable phenomenon is the AP scores for large objects (in terms of pixel number) are consistently greater than small ones. The potential explanation is that the larger objects have more information for the heat dissipation pattern that allows the machine to learn the features. The very high AP scores for large objects clearly in some cases (e.g., 87.77) suggest the strong potential of road sign recognition using thermal images, at least for the signs with larger area size or for those signs that were captured by the thermal camera at a closer distance. In addition, as expected, AP50 scores are constantly greater than AP75, since the higher IoU threshold poses a stricter criterion on the sign classification, and some of the TPs at the threshold of 50% would be removed at the cutline of 75%. In terms of different signs, the models seem to perform better on the signs of Stop, School Zone, and Others, while the rest, like Street Name, Speed Limit, and Yield, demonstrate the relatively inferior classification performance. There are

multiple reasons for such fact that contain the physical size of the sign, the distance away from the sign when the photo was taken, the uniqueness of the sign shape, the conditions of sign (e.g., new or damaged materials), and the number of images for each sign category. For example, the AP scores for Yield signs are 0 in two situations (i.e., bounding box and instance segmentation for both R_50_FPN_3x and R_101_FPN_3x models). The most likely reason is the sample size for this sign is the lowest among the six categories, given the somewhat rare applications of Yield signs. Interestingly, other models like R_50_C4_3x exhibit much better performance for the same Yield sign. Such finding indicates the sample size plays an important role in selecting Mask R-CNN models, which have a wide range of performance in terms of the image number for recognition training.

Even though the assessment results of individual models are clearly exhibited in Table II, it may be more interesting to compare the overall performance of different model types, including backbones (or R50, R101, and X101) and schemes (namely, FPN, DC5, and C4). Since the model type is categorical and the performance indices are numerical, ANOVA analysis was selected to test their associations. Given that there are many AP-related measures in the study, the primary metric, AP score (or the average one over the IoU from 0.5 to 0.95) for both bounding box and segmentation, is selected for ease of illustration. In addition, the inference time and total loss were included as well. The detailed ANOVA test results are shown in Table III. The three types of backbones appear to have no statistically significant impact on any of the four chosen performance indices. On the contrary, the schemes tend to exert a statistically significant influence on average inference speed, whereas a moderately significant impact on total loss. In a close review of the individual model results from Table II, it is known that average inference speeds for C4, DC5, and FPN are 0.36, 0.12, and 0.06 second(s)/image, respectively, and the corresponding total loss for the same three schemes are 0.15, 0.14, and 0.25, respectively. Such phenomenon implies that the faster image process is at the cost of a higher total loss, which usually leads to lower AP scores. Therefore, great caution shall be exercised to choose the most appropriate model schemes that balance inference speed and total loss.

Furthermore, the difference between the AP scores for the bounding box and the segmentation mask was also estimated. Finally, the paired t-test was applied with the detailed results displayed in Table IV. Based on p-values associated with the t-test, it is known that the AP scores for bounding boxes are more statistically significant than those of segmentation in classifying small objects, street names, and others. As a matter of fact, the bounding box AP scores are consistently larger than the segmentation counterparts across all 7 models for those three cases. Plus, the bounding box scores are moderately greater than those of segmentation in the speed limit and school zone cases. The easier task can explain the overall better performance associated with the bounding box for box generation that focuses only on the identification of four corner points, while the segmentation process involves the classification at the pixel level.

Table II. Detection Time and Various Evaluation Results for Different Models Under Different Conditions

Models	AIS	Bounding Box (Overall)						Segmentation (Overall)					
	AIS	AP	AP50	AP75	APs	APm	APl	AP	AP50	AP75	APs	APm	APl
R_50_FPN_3x	0.06	4.60	6.80	5.75	2.00	18.34	75.45	4.38	6.67	5.10	1.88	17.30	71.53
R_101_FPN_3x	0.06	3.56	5.14	4.75	1.38	14.21	87.77	3.62	5.12	4.44	1.25	14.71	82.21
X_101_FPN_3x	0.07	8.03	11.14	9.30	4.40	24.10	51.78	7.68	11.13	8.97	3.86	23.57	58.47
R_50_DC5_3x	0.11	4.13	6.65	4.91	2.37	16.59	68.88	3.94	6.46	4.16	1.94	16.13	69.90
R_101_DC5_3x	0.12	9.64	16.19	9.18	6.03	28.47	68.81	9.94	16.92	10.81	5.97	28.74	74.06
R_50_C4_3x	0.35	10.57	16.43	12.87	7.09	28.06	72.10	9.81	16.50	10.95	5.91	27.77	83.32
R_101_C4_3x	0.36	6.35	10.32	7.33	3.99	20.38	62.69	6.12	10.05	6.88	3.73	19.97	69.90

Models	LOSS	Bounding Box (AP Score by Signs)						Segmentation (AP Score by Signs)					
		stop	SL	Yld	St.	Sch.	Oth.	stop	SL	Yld	St.	Sch.	Oth.
R_50_FPN_3x	0.28	7.93	4.83	0.00	5.38	3.56	10.51	7.78	5.00	0.00	4.16	3.71	10.01
R_101_FPN_3x	0.26	8.76	1.19	0.00	3.04	3.86	8.09	9.11	1.04	0.00	3.20	4.16	7.84
X_101_FPN_3x	0.21	15.02	1.19	8.71	3.63	17.34	10.32	15.50	1.19	7.62	3.18	16.05	10.21
R_50_DC5_3x	0.12	7.43	2.18	3.81	4.93	3.07	7.50	7.43	2.84	2.72	4.28	2.97	7.37
R_101_DC5_3x	0.16	15.54	4.89	10.94	6.78	12.58	16.78	15.38	6.34	13.56	6.63	11.43	16.24
R_50_C4_3x	0.18	18.22	1.99	17.87	5.70	13.84	16.38	18.18	2.55	15.42	5.30	11.75	15.50
R_101_C4_3x	0.11	12.49	2.40	2.18	3.38	11.86	12.13	12.31	2.73	2.54	2.75	10.91	11.62

* AIS is average inference speed; LOSS represents the total loss as shown in Equation (2).
* For road signs, SL=speed limit, Yld. = yield, St. = street name, Sch. = school, Oth. = others.
* See section 3.3.3 for the definition of AP, AP50, AP75, APs, APm, and APl.
* The best performances are indicated by bold font under different criteria.

Table III.   Results of ANOVA Analysis between Different Model Types and Performance Indexes

Performance Index	Model Types	Df	Sum of Square	Mean of Square	F Value	Pr(>F)
Average Inference Speed	Backbone	2	0.010	0.005	0.199	0.827
	Residuals	4	0.098	0.025		
	Schemes	2	0.108	0.054	1297	2.37E-06
	Residuals	4	0.0002	0.00004		
Total Loss	Backbone	2	0.001	0.0005	0.077	0.927
	Residuals	4	0.025	0.006		
	Schemes	2	0.020	0.010	6.781	0.052
	Residuals	4	0.006	0.001		
AP of Bounding Box	Backbone	2	2.080	1.042	0.094	0.912
	Residuals	4	44.300	11.076		
	Schemes	2	11.360	5.680	0.649	0.570
	Residuals	4	35.030	8.757		
AP of Segmentation Mask	Backbone	2	2.030	1.014	0.097	0.909
	Residuals	4	41.640	10.410		
	Schemes	2	9.540	4.772	0.559	0.611
	Residuals	4	34.130	8.531		

* Df represent the degree of freedom.
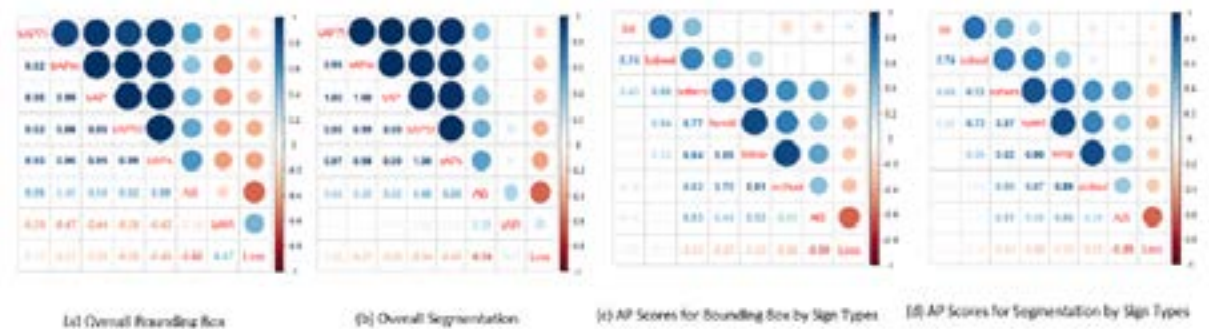* Pr(>F) represent the p-value which indicates the statistical significance of two groups relying on F value.
* The bold fonts signify the statistically significant difference among the model types under certain performance index, where the p-value is less than 0.05.
* The shade cells indicate the moderately significant difference with the p-value being less than 0.10.

Table IV.   Result of Paired T-Test between AP Scores for Bounding Box and Segmentation Mask

Items	Mean of Difference	Degree of Freedom	t-value	p-value
AP	0.196	6	1.590	0.163
AP_{50}	-0.026	6	-0.205	0.844
AP_{75}	0.397	6	0.999	0.356
AP_s	0.389	6	2.633	0.039
AP_m	0.280	6	1.434	0.202
AP_l	-3.130	6	-1.341	0.229
AP_Stop	-0.043	6	-0.427	0.684
AP_Speedlimit	-0.431	6	-2.139	0.076
AP_Yield	0.236	6	0.395	0.707
AP_StreetName	0.477	6	2.916	0.027
AP_School	0.733	6	2.210	0.069
AP_Others	0.417	6	4.032	0.007

* See section III.C.3 for the definition of AP, AP50, AP75, APs, APm, and APl.
ᵃ The bold fonts signify the statistically significant difference among the AP scores for bounding box and instance segmentation under certain performance index, where the p-value is less than 0.05.
ᵇ The shade cells indicate the moderately significant difference with the p-value being less than 0.10.

CONCLUSIONS AND RECOMMENDATIONS

Compared with other sensors like LiDAR and normal cameras, thermal imaging, which takes measurements based on temperature field distribution, demonstrates great benefits in capturing surrounding objects at night and other inclement weather conditions like fog, rain, snow, dust, etc. Even though road sign recognition has been extensively explored via different CV tools, very little research is dedicated to nighttime sign recognition using thermal images, which play an important role in various driver assistance programs, especially self-driving cars. The study aims to fill this gap by applying the state-of-art Mask R-CNN models to classify the road signs based on the images collected by the thermal camera at night from California communities. Specifically, 7 models consisting of various combinations of backbones and schemes were selected and implemented via the Detectron2 framework. Six sign categories were tested in the study. A number of performance measures, including six AP scores, average inference time, and total loss, were reported for bounding box, segmentation, and sign categories, which could allow for a comprehensive performance comparison among models and the detailed analysis of correlation across these indices.

Upon examination of various results as shown in the study, the following conclusions are made:

1) High sign classification accuracy was demonstrated for various mask R-CNN models, especially for those large objects in the images. Such finding illustrates the great potential of thermal imagery for nighttime road sign recognition, not to mention the results were obtained via a low-resolution camera with somewhat limited sample size.

2) The rapid inference was noted via the set of Mask R-CNN models in the Detectron2 framework, indicating these models' real-time prediction capability that is highly demanded by the driving activity.

3) Among all six categories of signs, the Stop and School Zone signs show the best performance. The potential reasons include the sample size, sign size and shape, photo-taking distance, and material conditions.

4) Individually, R_101_DC5_3x and R_50_C4_3x claim the best performance under 12 and 11 evaluation conditions, respectively.

5) Collectively, model schemes (FPN, C4, and DC5) seem to significantly influence inference speed and illustrate a moderately significant association with the total loss. By contrast, the backbone types appear to exert no statistically significant impact on any of the four chosen performance indices.

6) For bounding box and segmentation, the former generates better performance in most cases. The bounding box generation may be relatively easy that concentrates merely on the identification of four corner points, while the instance segmentation needs to be carried out at the pixel level.

Finally, it is desirable to explore the relationships among various performance indicators of the models. The pairwise correlation coefficients are presented in the different plots of Fig. 4, with the warm colors indicating the negative correlation coefficients and cold colors signifying the positive values. As expected, AIS and Loss demonstrate consistent correlations with almost all AP scores (except speed limit) for all panels, with the former showing the positive coefficients and the negative ones for the total loss. This trend suggests that the models need more inference time to achieve higher AP scores and lower total loss, and vice versa. Individually, all three largest correlation coefficients (i.e., 1) appear for segmentation tasks, which include the pairs of (AP, AP75), (AP, APm), and (AP50, APs). The potential reason is that the average precision score is closer to the values corresponding to the middle IoU threshold (or, 0.75) and medium sign during the segmentation process. The AP score associated with the IoU of 50% happens to be similar to the small objects. Regarding sign categories, the pair of (school, stop) for bounding box claims the highest correlation coefficient value (0.91). The possible explanation for such fact is that stop and school zone may have very close spatial heat patterns in terms of bounding box generation.

(a) Overall Bounding Box   (b) Overall Segmentation   (c) AP Scores for Bounding Box by Sign Types   (d) AP Scores for Segmentation by Sign Types

* See section III.C.3 for the definition of AP, AP50, AP75, APs, APm, and APl.
ᵇ AIS is average inference speed.
ᶜ Loss represents the total loss as shown in Equation (2).
ᵃ The coefficient sizes indicate the statistical significance. The more statistically significant the correlation coefficients, the larger the font for the correlation value.

Fig. 4.   The Plot of Correlation Matrix for various Performance Indexes of Models

7) Overall, the average inference speed seems to be inversely related to the prediction accuracy. Hence, greater caution needs to be exercised for the model selection for the best trade-off between processing speed and recognition accuracy.

Although the research presents pioneering efforts for nighttime road sign recognition using thermal images, further work is still needed. First, the thermal image data were collected via a low-resolution camera, data of other resolutions are worth exploration for a comprehensive evaluation of the model efficiency, as the previous research has demonstrated the significant impact of data resolutions on object detection accuracy [68]. Second, the different sign categories showed mixed performance due to the different sample sizes across the sign types. Therefore, mode photos need to be taken to evaluate the model performance further, especially for the signs with a smaller sample size (e.g., Yield). In addition, other methods could be tested to address the limited size issue, such as data sample improvement via a semi-supervised algorithm, employment of more iterations, or implementation of additional data augmentation like brightness and saturation-adjusting. Third, the study focused only on the evaluation criterion of AP, different measurements like a set of average recall scores can be employed for a more reliable assessment of models from various angles. Moreover, sophisticated CV algorithms like YOLOv4 are also worth examining for thermal sign recognition. Finally, for readers wishing more details about the study code, data, and other materials, the web link can be accessed for such information: https://github.com/KossBoii/RoadSignDetection.git.

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Evaluating the Mechanical Properties of Pre-Consumer Twill Woven Cotton Materials

Abstract

Recycling has become a key theme within an emerging segment of the apparel industry. According to the Environmental Protection Agency, the U.S. apparel and footwear textile waste generated in 2018 totaled 17 million tons. However, only 6.77% of these materials were reclaimed for recycling. The process of reclaiming apparel products and textiles for recycling has set a multitude of industry players to emerge as a segment that diverts textile waste from landfills for redistribution. Current studies have explored sustainable fashion interests but have not evaluated the quality of textiles for upcycling from a mechanical perspective. This study engages with the current textile recycling industry by sourcing pre-consumer cotton twill woven materials and conducting textile mechanical tests. Due to the lack of textile recycling generation, this study contributes to the opportunity upcycling has as a method of sustainability by diverting landfill and reusing quality material. The study involves three parts, (1) sourcing pre-and post-consumer cotton twill materials, (2) conducting mechanical quality testing, and (3) proposing recommendations for product development based on mechanical performance. An experimental study was conducted on a post-consumer cotton twill textile product and 2 yards of post- industrial cotton twill remnants by evaluating material mass/fibers, tensile strength, abrasion resistance, pilling resistance, and failure in sewn seams based on ASTM standards. Based on our findings and analysis of data, we found upcycling post-consumer waste as a feasible material to us in increasing the method for sustainable action and consumption. With an abundance of textile waste entering landfills, this study aims to expand knowledge on the prospective performance of post-consumer cotton twill woven materials by further informing high-quality upcycling for product development.

Introduction

Over the past two decades, contemporary consumption has pushed apparel production to new all-time highs. This has led to the generation of textile waste and the depletion of natural resources such as the use of water, land to waste contribution, and environmental biodiversity (Gopalakrishnan & Matthews, 2018). With the increasing demand for fashion and the rapid growth of globalization, the apparel industry has acted upon fast fashion for cheap industrial production contracts. From 2000 to 2014, the number of garments purchased each year by an average consumer increased by 60% (Koszewska, 2018). This type of production has offered no exit for old, usable clothes/fabrications that consumers rapidly discard for new trends but only enables economic growth and well-being for the overall system (Dissanayake & Sinha, 2015). During this time, the apparel industry saw a constant flow of newness and cheaply priced products being marketed and consumed by consumers whose knowledge of ethical and environmental issues surrounding apparel production and consumption was hidden (Ertekin & Atik, 2014; Henninger et al., 2016). The combination of consumer consumption and max production capacity has ultimately led to an evolutionary change in the individual value of apparel, the monetary value of apparel products, and the perception that favors quantity over quality (Koszewska, 2018). Therefore, as the range and volume of production increase over time, the apparel industry must also acknowledge the adjacent result of the action, the growing exponential problem of material disposal (Muthu, 2014).

In a recent report by the Textile Exchange (2020), global fiber production has reached an all-time high of 111 million metric tons (mt) and will project to rise by 30% within the next decade. In addition, global fiber production is primarily synthetically made from non-renewable resources, which comprises 52% of the fiber market compared to natural materials, which make up around 30%. Most of the apparel industries waste and pollution derive from synthetic materials due to cost-efficiency and overall performance characteristics (Schumacher, 2022). Unfortunately, only 14% of synthetic and 25% of natural materials are recycled/preferred, leaving the rest in landfills or exported to developing countries as secondhand textile waste (Lewis et al., 2017). According to a report written by the Global Fashion Agenda (2018), total fashion waste will amount to 148 million tons by 2030 as an increase in volume has outpaced the availability of land for landfills and cost of managing textiles waste. This sacristy of resources has caused growing concern about pollution/health and has uplifted awareness for sustainable alternatives (Muthu, 2014). Therefore, one of the industry's most challenging problems is its ability to reduce and minimize the percentage of waste created and currently going into landfills.

Although fashion consumption and sustainability are contrary, the fashion industry is to integrate sustainability aspects into their business to strive for resource conservation to reduce environmental burdens developed by fast fashion (Bly et al., 2015). Many companies are developing initiatives to reduce the use of chemicals, water, and waste to adapt to the emerging niche of sustainability (Cattermole, 2018). However, as sustainability has risen in significance, sustainable fiber and material use has slowly progressed, yet to see the industrial speed and scale required, which allow it to enact material change (Textile Exchange, 2020). With an estimated 84% increase in the demand for textile within the next 20 years, it is critical to effectively utilize resources that further offset environmental burdens over the years to come (Koszewska, 2018, Gopalakrishnan & Matthews, 2018).

With the abundance of textile waste entering landfills and a growing segment in sustainable action, this study aims to expand knowledge on the material performance of cotton twill material waste and the current yield of textile recycling within the apparel industry. This is a three-part research study that involves (a) sourcing cotton twill material waste, (b) conducting mechanical material testing based on ASTM standards, and (c) specifying recommendations for product development based on mechanical performance. By exploring textile waste, this study aims to expand awareness of the prospective performance of post-consumer waste, and cotton twill materials, by further informing high-quality upcycling for sustainable product development that will divert waste from landfills.

Literature Review

Current Fashion Industry

Fashion is driven by mass production and consumption. Mass production and consumption was driven by international trade policies implemented during the late 1990s. During this time, government policies influenced lowering tax rates on imports/exports and loosening trade regulations, which allowed for manufacturing to shift to developing countries with lower labor cost and fewer legal regulations (Schumacher, 2022). As a result, from 2000 to 2014, the number of garments purchased each year by an average European consumer increased by 60% (Koszewska, 2018). In congruent to the development of manufacturing and consumption, the concept and conversation of sustainable fashion has steadily risen to the forefront in every sector of the apparel industry as more studies have examined the concept's critical role and the burden of manufacturing (Henninger et al., 2016; Moorhouse, 2017). Today, Sustainability has become a driving force in uplifting industrial methods and practices of past generations through technology, developments, and initiatives (Ertekin & Atik, 2014), as it aims to regain a healthy balance between the industry and the environment that surrounds it (Cattermole, 2018).

Production. Fast fashion, the concept of mass manufacturing while marketing low quality and cost clothing, has been at the forefront of the apparel industry for the past two decades, totaling 100 billion garments in yearly output (Lewis et al., 2017; Schumacher, 2022). The production of cheap apparel goods is also directly aligned with the effort to expand the fashion system's overall economic well-being and thus, overlooks environmental consequences (Cattermole, 2018; Ertekin & Atik, 2015). In addition, with the abundance of apparel products produced and then consumed, the apparel industry currently still operates in a linear model economy (Produce, Use, Dispose) and has made it one of the many polluting and unsustainable industries known today (Kim et al., 2021; Lewis et al., 2017). This type of model economy has led to a drastic change in the value of clothing and has taught consumers that an abundance of cheap goods, made primarily from synthetic materials, will prosper over quality goods, regardless of durability (Koszewska, 2018). Therefore, if the industry continues the linear model economy, within the next ten years, production and consumption will put a strain on the environment and stretch our resources to a breaking point (Koszewska, 2018). With the popular rise of fast fashion and the mass distribution of synthetic materials in textile products, the apparel industry has influenced consumer perceptions of the value and quality of clothing (Koszewska, 2018; Textile Exchange, 2020).

The birth of a new era in fashion had occurred, as the concept and market of fast fashion played an increasing role in fiber production through its development in aggressively discounting garments and making the consumer consume, wear-less, and dispose of frequent (Lewis et al., 2017). Fast fashion products tend to be lower in quality and are not suitable for resale or repair. As a result, the overproduction of low-cost, low-quality clothing have also gained significant social and environmental implications.

Sustainable fashion has developed from the awareness of the impact clothes have on the environment and ethical standards (Henninger et al., 2016). It aims to reduce the number of collections, emphasize material balance, and encourage quality products that are made to last, as opposed to the fast fashion cycle of consumption (Ertekin & Atik, 2014; Henninger et al., 2016). In a similar notion, a circular economy aligns with the future perspective of global sustainable development as it combines the production and consumption lifetime of products into one by assuring the recycling of all products with minimum energy (Ma et al., 2019). This economy promotes a circular loop of ethical production and consumption, which fundamentally extracts maximum value from resources to Reduce, Reuse, and Recycle (Cattermole, 2018). The goal is to develop a regenerative system or framework that considers resource efficiency, biodegradability, longevity, and recyclability into account as the value of the resources and materials are maximized in use and out (Cattermole, 2018; Kim et al., 2021). Transitioning to a circular economy will indeed reduce pressure on natural resources and create domestic and sustainable growth in the economy of fashion but will also face industry-changing challenges that will need a collaborative effort to improve on (Cattermole, 2018; Schumacher, 2022).

Consumption. With the rapid growth of globalization, major fashion retailer has turned to hyper-consumption to meet their business needs by way of cheap industrial production contracts and unsustain consumption practices of consumers. Some implications of unsustain consumption practices are that inexpensive products will drive unsustainable consumption behavior, a new culture of consumption and disposal, and the development of a downward spiral in resources (Cattermole, 2018; Schumacher, 2022). As a result, consumers have a hard time caring about things they don't see like the production end of apparel (Bly et al., 2015). Therefore, with increasing consumption and the lack of consumer knowledge, an influx of consumption has influenced consumers to want more for less. Some consumers have exited the fashion system because of awareness however, it is ultimately the responsibility of the fashion system to re- invent and create new cultural meaning in modest and radical ways that will induce change and reflect a sustainable model that is economically viable for the future of health, the environment, and apparel businesses (Bly et al., 2015; Ertekin & Atik, 2015).

In response to the over-consumption of fashion cycles, sustainability has encouraged many new perspectives in fashion and has offered the industry an opportunity to develop a new model economy, one which does allow billions of garments to go to waste within 12 months of being made (Schumacher, 2022). As sustainability has risen to the forefront, producers and consumers are becoming more knowledgeable of the impact apparel manufacturing /consumption has on the environment and society (Henninger et al., 2016; Moorhouse, 2017). However, due to the lack of knowledge, awareness, and model of sustainable action, consumers are unable to fundamentally grasp a holistic definition and perspective of the concept of sustainable fashion/consumption (Henninger et al., 2016). Due to limited information provided by the industry, consumers have in turn made sustainable fashion a niche market, which appeals to a certain group of consumers, rather than a mass-market (Bly et al., 2015). To adjust to sustainable fashion, an entire industry effort is necessary to advance sustainable solutions to the scale required to induce industry change (Cattermole, 2018). Therefore, as sustainable awareness grows, industry change must emerge and meet the challenges of the fashion system by implementing new models of

economies that integrate environmental and ethical benefits. Currently, 50% of millennials and 54% of Gen Z have reported that they are willing to spend an additional 10 percent or more on sustainable products and represent a large percentage of purchasing power in the years to come (Kim et al., 2021). This finding has motivated various industries to develop a more sustainable system that can apply to those generations' sentiments.

The Issue of Textile Waste and Potential Solutions

One of the apparel industry's most challenging problems when transitioning to a circular economy is its ability to reduce or eliminate the percentage of textile waste (Koszewska, 2018). According to the Environmental Protection Agency, the U.S. apparel and footwear textile waste generation in 2018 totaled 17 million tons. However, only 6.77% of these materials were recycled or reclaimed. Textile products are a waste stream, which typically ends up in landfills or are cremated for energy and thus, contribute to greenhouse gas emissions (Muthu, 2014). The textile and apparel industry are known to cause severe damage to the environment through inefficient use of natural resources and the abundant accumulation of textile waste for disposal.

Today the industry is generating more than 92 million tons of textile waste annually, combined with the lack of landfills and the rising cost of textile waste management, has allowed an abundance of textile waste for export to developing countries for economic well-being or as second-hand textile waste (Cattermole, 2018; Kim et al., 2021). In addition, a well-known feature of textile waste and apparel products is the mix of fiber/fabric types which, if sent to waste or incinerated, the composition of the different materials will lead to the decomposition of some fibers and the release of the toxins from others (Lewis et al., 2017). In addition, from 2000 to 2018, textile waste generation has been on a linear increase of 80 %; on a per capita basis, textile waste grew 55 % over the same period; stating that an individual increased their generation of textile waste due to the constant flow of fashion cycles (Gopalakrishnan & Matthews, 2018; Schumacher, 2022).

Textile waste often is divided into two major categories: Post-Industrial Waste and Post- Consumer Waste (Muthu, 2014). Post-Industrial Waste is textile waste that has reached the recycling phase at the industry gate rather than after consumer use. Post-Consumer Waste is considered textile waste that has reached the recycling phase after consumer use. Although different in source, most of the textile waste comes from Post-Consumer Waste as the volume of this type of waste increased by 40% from 1999 to 2009 (Gopalakrishnan & Matthews, 2018). During this time, fast fashion cycles generated significant amounts of post-consumer textile waste in the form of second-hand clothing (Lewis et al., 2017). It is estimated that thrift stores sell approximately 20 % of the textile collected, while the remainder is sold to sorters and graders, who assess and sort the textiles based on quality and condition to be sold to appropriate markets, turned into new products, or sent for disposal (Schumacher, 2022). However, when compared to incineration and landfilling, reuse, and recycling, particularly reuse, have been considered more beneficial in reducing the environmental impact of waste (Patti et al., 2020).

Five appropriate mechanisms in recovering the value of textile waste are to repair/reuse, refurbish, remanufacture, and recycle; however, reuse and recycling are highly desirable options for waste management and gaining environmental benefits (Dissanayake & Sinha, 2015; Muthu, 2014). Recycling is the one of many methods to divert, manage, and reuse remaining textile waste and generally include the deconstruction of a discarded product after use and further processing of textile components to create either a similar or a different product (Muthu, 2014). Recycling is also one way to balance shrinking resources against a growing population. Currently, less than 1 % of textile waste collected go to fiber-to-fiber recycling, as the main category of waste best suited for recycling is post-consumer textile waste or used products (Ma et al., 2019). Although, consumer awareness of sustainability has increased demand towards industry change in practices (Bly et al., 2015; Henninger et al., 2016), there have been difficulties with recycling garments because of the lack of separation between fibers in the textile waste which has led to the textile waste recycling rate to amount to only 12% of total waste (Cattermole, 2018; Ma et al., 2019). These material wastes are at the end of their consumer lifecycle and are ready to be obtained, managed, and converted to a different product with different functions but often lack the correct infrastructure needed to further sort and grade for the mass market recycling (Schumacher, 2022). With an estimate of an 84% increase in the demand for textile fibers in the next 20 years, a regenerative system that takes resource efficiency and recyclability into account is necessary for recycling textile waste to lower environmental burdens (Ma et al., 2019; Schumacher, 2022).

Towards a Circular Economy. According to a study by Schumacher (2022) evaluating the status of a circular economy, textile waste includes apparel products, home textiles, uniforms and workwear, upholstery fabrics, manufacturer or retailer overstock, deadstock, off-spec, damages, and returns. The phenomenon of textile waste creation is a function of the linear economy, in which products are created, used, and dumped without further application (Ma et al., 2019). Adopting a circular economy will require a new approach to apparel design and production than what is modernly known, which integrates textile waste into a circular equation to minimize the abundance and divert it from landfills (Cattermole, 2018). The transition from a linear to a circular economy is necessary due to the continuous harmful effects of nonrenewable resources in textile products and the amount of textile waste found in the current system. The first step toward a circular economy model will be reducing or minimizing the current waste this is being tossed into landfills since the total level of fashion waste will rise to 148 million tons by 2030, according to a recent report by the Global Fashion Agenda (2018). The collection of textile waste often includes thrift stores, drop-off centers, collection programs, donation bins, and takeback programs and accounts for only 15% of discarded clothing and textiles captured for reuse or recycling (Schumacher, 2022). Therefore, with the increasing demand for cyclical fashion, an innovative approach is needed to manage, recycle, and/or reuse textile waste, as globalization of apparel production and development has grabbed the interest of global consumption.

Upcycling For Product Development. Limited research has considered remanufacturing textile waste for apparel product development. Apparel products can be developed from discarded waste by way of sustainable action. Remanufacturing is the process of reusing discarded products by upgrading or restoring the quality of the product

and thus, extending its lifespan (Gopalakrishnan & Matthews, 2018). Upcycling, another form of remanufacturing, however, with a different outlook on design and value, is set to achieve a higher value at retail than the original product would, in which a remanufactured garment would be of at least equal or better than before (Dissanayake & Sinha, 2015). Secondly, the upcycling process can eliminate the need to use finishing processes, which has impacted human health and damaged surrounding ecosystems. But the process can also be very labor-intensive, as it requires material sourcing, material analysis, and an abundance of creative design thinking to find the solution for remanufacturing (Cattermole, 2018). In addition, upcycling consists of an end-of-life management plan to use waste as source material and divert it from landfills as a product end-use in upcycling can also serve a completely different purpose or function from its original intention (Henninger et al., 2016). Current studies have also revealed that remanufactured fashion and 'zero-waste' solutions have become more acceptable among consumers by using design and production processes to achieve 100% utilization of discarded textiles (Lewis et al., 2017). The concept of upcycling and remanufacturing is strongly tied to product development however, the lack of standards for textile waste has put a constraint on continually quality of design or consumers outcomes (Koszewska, 2018). Therefore, obtaining the highest quality material for reuse and durability for an upcycled garment can be time-consuming due to the discovery of utility and efficient means for material, let alone sourcing for the correct material. When upcycling, it was found that documenting the most common material composition would be the most beneficial for the upcycling process as the remanufacturing aspect can better anticipate and thus, be ready for redesign/upcycling (Lewis et al., 2017). To be more effective in upcycling product development, the industry would need to intensify its efforts that introduce new business models and textile technology that can ultimately help the industry have a smooth transition of economies (Koszewska, 2018).

Material Quality & Performance. As innovation moves toward materials that can be reused and reintegrated, consumers must also feel confident about upcycled material as a product purchased, which accounts for the durability, effectiveness, longevity, and function of a product (Cattermole, 2018). Material testing incorporates various procedures that evaluate the nature, characteristics, and performance of materials and interactions (Kadolph, 2007) yet, brings many constraints in developing new design ideas through upcycling. Material testing results in spending significant time analyzing the available materials due for disassembly rather than working on redesigning products (Dissanayake & Sinha, 2015). However, the knowledge of material testing is often necessary and typically discovered in a lab as so to enable the suitability of materials for products, predict material performance for product end-use, and guarantee consumer satisfaction of the desired end use (Kadolph, 2007). Overall, a material that is not able to give the required strength and properties for a product end-use, can no longer be considered a suitable material for product development (Ijaz, 2020a). Durability is one of many categories listed for testing performance and addresses how a material performs against physical and mechanical force/stress applied. In addition, the mechanical properties that are important to a design engineer differ from those that are of interest to the manufacturing engineer, therefore the response of the textile material depends on testing mechanical properties (Ijaz, 2020a, 2020b). The procedures of durability testing can be divided into two emphases: the ability of strength and the effect of friction on materials; and are tested in intervals until their breaking point when the Material is no longer acceptable to consumers as a product (Kadolph, 2007).

The evaluation of durability testing can be measured in force, change in performance, change in appearance, or by comparing to rating standards that represent a change in material over time. Fabric is a complex structure made up of different types of fibers and yarns and can be difficult to predict its physical characteristics (Ijaz, 2020a). Therefore, understanding mechanical properties play an important role in the serviceability of textile materials.

Analysis of Cotton Materials. Among world fiber consumption, cotton is the most consumed fiber after polyester. Cotton-based textiles, such as denim, represent a significant proportion of textile waste to which the use of these waste materials would facilitate environmental protection (Ma et al., 2019). Cotton production indeed has severe environmental impacts in terms of water consumption, land occupation, emissions, and use of pesticides. On average, it takes 140.1 MJ (Megajoule) of energy and an output of 5.3 kg of CO_2 (Carbon Dioxide) to produce 2 lbs. of cotton fabric (Ütebay et al., 2019). However, cotton is a suitable material for regenerated cellulosic fiber and has become increasingly popular in the textile market and can never be replaced by synthetic fibers due to their unique properties such as superior moisture absorption, breathability, and excellent mechanical properties (Ma et al., 2019). The weaving structure of fabrics also affects the mechanical behavior of products. One of the most common fabric manufacturing methods is the interlacing of yarns and woven materials which are found to be the most versatile and complex in design (Sayem & Sagor, 2021). The interlacing of woven fabrics provides strength to the material and is considered long-lasting as compared to any other manufacturing technique (Ijaz, 2020b).

Various studies have acknowledged the mechanical properties of cotton-woven materials. In a study by Jahan (2017), strength and elongation were found to be the most important performance properties of fabrics governing the fabric performance in use. The tensile strength, the maximum force a material can take per unit area, and Abrasion, loss of performance characteristics, and appearance, were found high in normal woven fabrics due to the no. of interlacement of warp & weft is more in plain weave, allowing way a greater number of crossover points in interlocking as compared to other weave types (Ijaz, 2020a; Jahan, 2017). Twill weaves, on the other hand, showed a noticeable increase in tensile strength in the warp direction as compared to normal woven materials (Ijaz, 2020b). Nevertheless, plain weave is the strongest among other tested weave structures. It can be concluded that tensile strength, abrasion resistance, stiffness & pilling resistance are high in plain weave compared to twill weave because these mechanical properties improved with the increasing no. of interlacement of yarns (Jahan, 2017).

Methods

The objective was to collect and analyze quantitative data through mechanical testing that measures the feasibility of textile waste utilization of post-consumer waste and post-industrial waste. A three-part method was developed to explore the future performance of recycling post- consumer cotton twill material and further inform high-quality upcycling for product development. Using an experimental research design, our focus was on examining the mechanical properties of post-industrial and post-consumer cotton twill woven textile waste. The post-consumer waste was sourced at an army surplus store called The Supply

Sergeant located in Downey, California. We were able to allocate army green twill woven cotton duffle bags as post- consumer textile waste, waste after consumption. The post-industrial waste was sourced in the Los Angeles Fashion District as industrial textile waste. We were able to allocate 3 yards of white woven twill cotton as post-industrial textile waste which acts as a standard for post- consumer textile waste performance. In total, two types of materials were tested: Green Twill Woven Cotton and White Twill Woven Cotton which accounted for a composition of 100% cotton. Mechanical testing was performed at Cal Poly Pomona's, Apparel Merchandising and Management, Textile laboratory. During the test, the laboratory room temperature ranged from 72-75 degrees Fahrenheit with 57% relative humidity. The following table provides an overview of the Mechanical Material Testing that was conducted on the sourced materials. Based on mechanical performance, recommendations will then be proposed for product development by way of data analysis.

ASTM Test Standard Guideline

Test	Cut	Data
ASTM D3776 – Mass per unit Area (Weight) of Fabric	5 of 2 x 2	Area Conversion of grams to oz/yd^2
ASTM D5034 – Breaking	**Dry** 5 Warp 4 x 6	Residual Breaking Force (Instron) Avg time to Break
Strength and Elongation of Textile Fabrics – Grab Test	8 Weft 4 x 6 Draw a line 1.5" away from edge of fabric	
ASTM D3884 – Abrasion Resistance of Textile Fabrics	5 of 6 x 6 square – for test 5 of 6 x 6 square – for control Position diagonally Cut ¼" diameter hole in the center	Residual Breaking Force (Instron) Avg breaking strength Percent loss in breaking strength Cycles to a specific end point (can use yes/ no) • Loss in breaking strength • Yarn breakage • Loss in coating • Loss of luster • Napping • Pilling • Color loss • Other
ASTM D1683 – Failure in Sewn Seams of Woven Fabrics	5 Warp 4 x 6 5 Weft 4 x 6	Sewn seam strength Seam efficiency Seam slippage (If possible) • Rupture characterized by fabric breakage or thread break or slippage

Results & Analysis

After conducting testing, data was collected and analyzed to compare each material to the other. The standard, post-industrial twill data is shown in bule while the upcycled, post- consumer, twill data is in red.
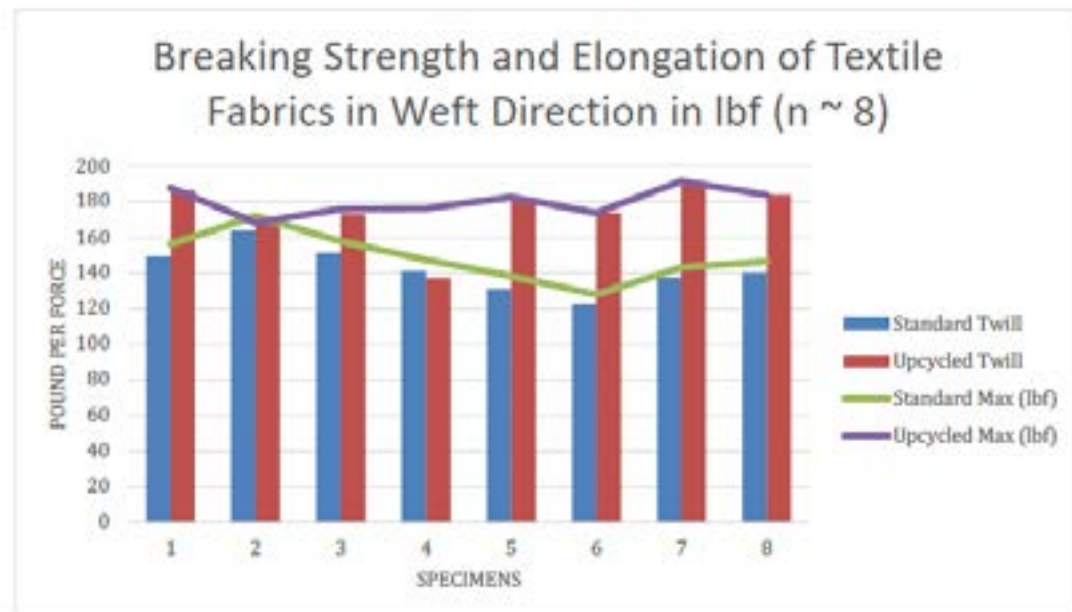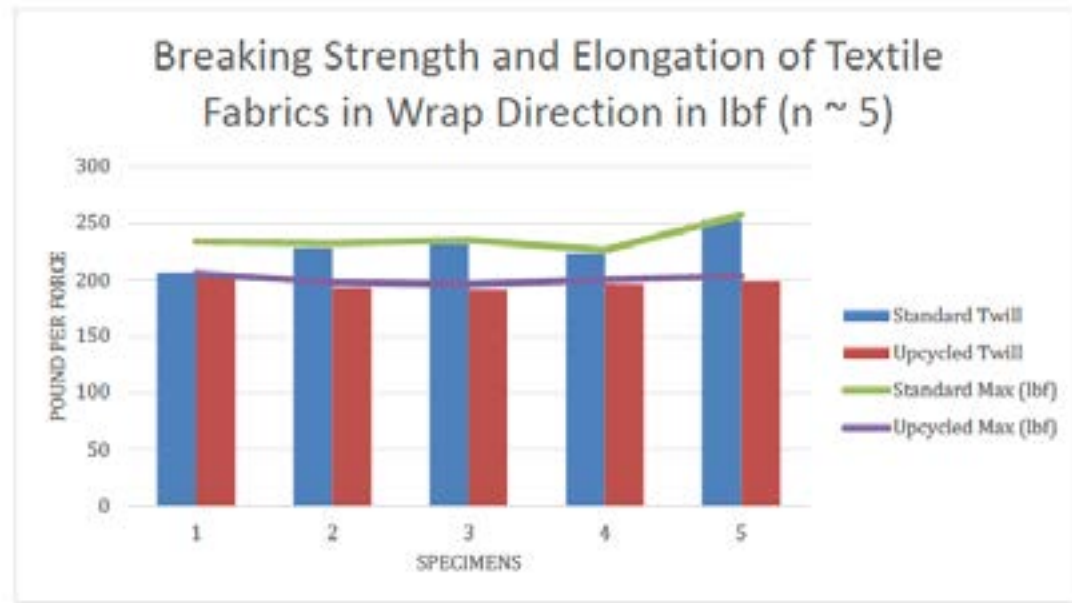ASTM D3776 – Mass per unit Area (Weight) of Fabric
In our first analysis, we measure the weight of each material in Oz per square yard 5 times using small samples (2x2) located across the material randomly. With our 5 sample sets of each material, we can accurately compare the weight of each sample with each material. In addition, the chart below shows the median weight for both materials to be roughly around 9.75 to 10.25 Oz per square yard. This means that the material is heavy weight and is best suited for tougher conditions like winter clothes, workwear, or heavy sweaters. Ultimately, our post-consumer textile waste, upcycled waste, was more consistent in achieving the stated heavy weight, while our post-industrial waste was either in the median range or heavier.

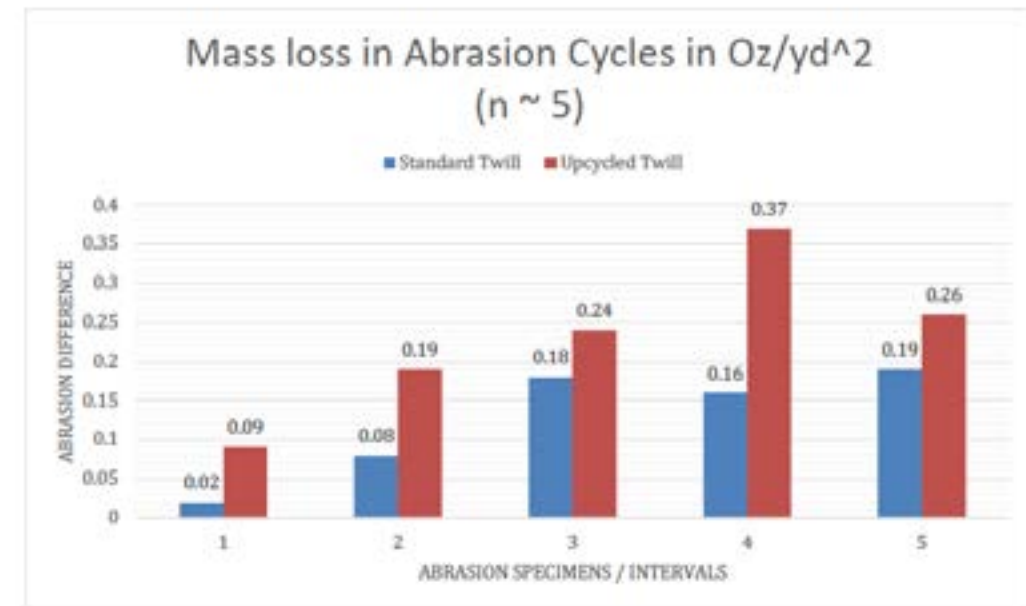ASTM D5034 – Breaking Strength and Elongation of Textile Fabrics – Grab Test
In our second analysis, we conducted material testing that shows the effective strength of the fabric in use by conducting ASTM standard grab test in both fabric directions. This type of material testing allows us to acknowledge which of the two materials is stronger and can apply more force in use to. Conducted on an Instron apparatus, with 5 (4x6) samples in Warp and 8 in the Weft. Our findings acknowledged that Standard Twill is Stronger than Upcycled Twill in the Wrap direction and can take a little more force and extension. This can be seen by the increasing gap standard twill has on the upcycled twill over the 5 samples specimens. In addition, the standard twill is fairly consisted with the force it's able to take on, while the upcycled twill is seemly average and is consider post-consumer waste, used already. Nonetheless, when looking at the pound per force max range of both twill materials we can see that both the materials are similar in force applied to each other in warp. Regardless, the story of force changed when examining the weft direction of each material. There is a drastic different in force being applied and the ability to take in the force, as standard twill has seen a steep decline in its ability. When compared to upcycled twill, the weft direction is as solid as the wrap direction thus, enabling the further potential use of this material for product development. In conclusion, vertically, Standard Twill is Stronger than Upcycled Twill and can take a little more force and extension in the warp. However, Horizontally, Upcycled Twill is Stronger than Standard Twill and can obtain a more substantial force and extension in the Weft.

Breaking Strength and Elongation of Textile Fabrics in Wrap Direction in lbf (n ~ 5)

Breaking Strength and Elongation of Textile Fabrics in Weft Direction in lbf (n ~ 8)

SPECIMENS	ABRASION INTERVALS
1	500
2	1,000
3	1,500
4	1,750
5	2,000

Mass loss in Abrasion Cycles in Oz/yd^2 (n ~ 5)

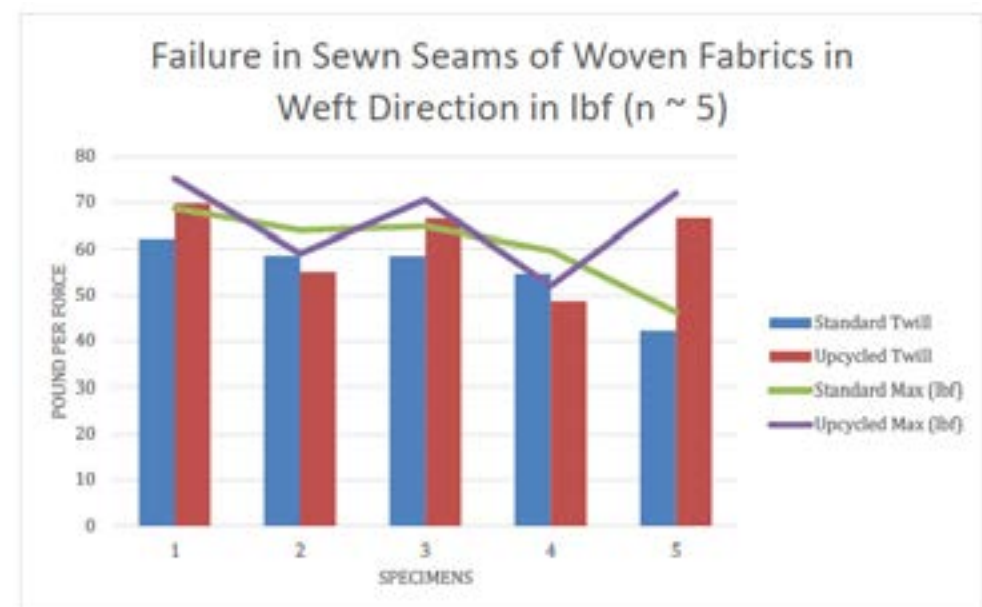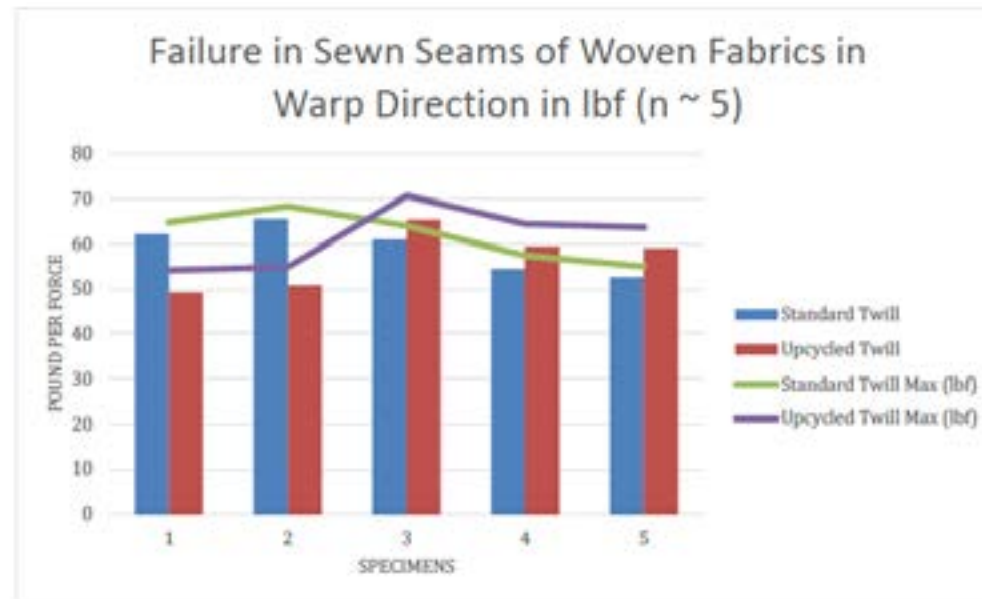**ASTM D3884 – Abrasion Resistance of Textile Fabrics**
In our third analysis, abrasion resistance was considered as is just one aspect of wear that shows the rubbing away of component fibers & yarns. This mechanical testing uses a flat abrasion to create wear and tear and test each material to show the thread breaking point as each interval. With each interval, the damage done unto the material increased. Both materials ended up breaking thread at the fourth interval, 1,750 revolution in abrasion.
With the increase of abrasion at intervals, we account for the loss weight of each specimen and compare the difference between the two materials. In conclusion, Standard Twill is substantially more durable than Upcycled Twill but is not post-consumer waste, which means less usage and an increased performance capability. This was foreseen as upcycled twill is post-consumer waste and can be accounted various use before it could this point, allowing for less performance and a lower lifecycle. Nevertheless, the mass loss in abrasion has done significant damage unto the upcycled twill materials.

ASTM D1683 – Failure in Sewn Seams of Woven Fabrics
In our fourth and final analysis, like our second test of breaking strength, we measured the sewn seam strength in woven fabrics by applying a force perpendicular to the sewn seams. Conducted on 5 samples that were sewn attached and then place within a grab test for the extenuation of force on the sewn seam. This helps us Identifies the sewn seam strength threshold at which the failure of the stitching occurs, without damage to the fabric, so that the textile product can be repaired. When evaluating the wrap direction, we found an inverse relationship between the two materials, and therefore, we would like to conclude that Standard and Upcycled Twills are similar in seam strength in the vertical direction. Although, the data will be inversed and nonuniformity is found, the performance on the long-term basis will be about the same as the range found in pound per force is roughly around 50 – 70 pounds per force. However, in contrast, when carefully looking upon the weft direction we found a steep decline in sewn seam strength for the standard twill while the upcycled twill maintains an exponential rising average. Therefore, horizontally, Upcycled Twill is consisting stronger in sewn seams than Standard Twill enabling less repairs of textile products.

Failure in Sewn Seams of Woven Fabrics in Warp Direction in lbf (n ~ 5)

Failure in Sewn Seams of Woven Fabrics in Weft Direction in lbf (n ~ 5)

Recommendations for Product Development

Based on my findings the Army Surplus Green Twill Woven Cotton is overall better in all tests conducted expect regarding abrasion resistance. Abrasion is just one aspect of wear & is the rubbing away of the material fibers & yarns. However, the potential upside on our tested upcycled material has shown resilience in heavy weight products, is stronger than standard twill and can obtain a more force and extension in the weft direction, performs just as similar as standard twill in the vertical direction for seam strength, but is found to consist of much stronger sewn seams within the weft direction than Standard Twill thus, enabling less repairs of textile products. Based on my findings, this type of post-consumer waste can be allocated for:

• Work Clothing/ Apparel Bottoms
• Apparel Assortments (Backpacks/ Duffle Bags/ Keychains)
• Variety of Footwear Trims (Boots, Running Shoes)

Conclusions

Over the past two decades, contemporary consumption has pushed apparel production to new all-time highs. This has led to the generation of textile waste and the depletion of natural resources such as the use of water, land to waste contribution, and environmental biodiversity (Gopalakrishnan & Matthews, 2018). In 2018 only, an average of roughly 47 kilograms (103 pounds) of textiles was discarded by each person in the United States, with the primary waste being apparel products (Schumacher, 2022). Therefore, it is a critical and urgent time for sustainable fashion and consumption to become more feasible to enact change towards reducing and rebalancing the industry's environmental impacts. As innovation moves toward materials that can be reused and reintegrated, consumers must also feel confident about upcycled material as a product purchased, which accounts for the durability, effectiveness, longevity, and function of a product (Cattermole, 2018). Material testing incorporates various procedures that evaluate the nature, characteristics, and performance of materials and interactions. Such knowledge is often necessary and typically discovered in a lab as so to enable the suitability of materials for products, predict material performance for product end-use, and guarantee consumer satisfaction of the desired end use (Kadolph, 2007). Therefore, by using an experimental research design, this study was able to collect and analyze quantitative data through mechanical testing that measures the feasibility of textile waste utilization of post-consumer waste, upcycled, and post-industrial, standard, waste. Within our testing, we acknowledged that the Army Surplus Green Twill Woven Cotton post-consumer waste was better suited for product development than the standard twill woven cotton post-industrial waste. Although different in source, most of the textile waste comes from Post-Consumer Waste as the volume of this type of waste increased by 40% from 1999 to 2009 (Gopalakrishnan & Matthews, 2018). Therefore, based on my findings and analysis of data, the Army Surplus Green Twill Woven Cotton is overall better in all tests conducted except regarding abrasion resistance due to the reason that it comes directly from consumer use rather than industrial use. In addition, the potential upside of our tested upcycled material has shown resilience in heavyweight products, is stronger than standard twill and can obtain a more force and extension in the weft direction, performs just as similar as standard twill in the vertical direction for seam strength, but is found to consist of much stronger sewn seams within the weft direction than standard twill thus, enabling fewer repairs of textile products. Furthermore, based on mechanical performance, the post-consumer textile waste can be allocated for work clothing, apparel assortments, and a variety of footwear trims. Future research should discover the potential long-term outlook on a project that could be turned into to remanufactured fashion collection against its counterparts for the consumer to acknowledge the difference and each garment's contribution to the world.

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**Associations Among Implicit Bias, Self-Reported Attitudes, and
Hate Crime Sentencing Recommendations**

Abstract

It was hypothesized that expression of prejudice, bias, or both would be exacerbated when transphobia and racism were both present. Data from a sample of 256 participants were collected. Higher scores on the Transgender Attitudes and Beliefs Scale (TABS; a measures of transphobic attitudes) were associated with higher scores on a measure of Hostile Sexism (HS), r(254) = .63, p < .001. IAT D-scores were associated with Hostile sexism, r(235) = -.33, p < .001. D-scores were also associated with TABS, r(235) = -.33, p < .001. Additionally, results indicated that more conservative political ideology was associated with greater bias against transgender Asian people on the IAT; D-scores were associated with political ideology, r(234) = -.28, p < .001. Political ideology was found to be associated Hostile Sexism [r(247) = .51, p < .001, and TABS, r(247) = .51, p < .001], such that greater levels of conservatism were associated with greater hostile sexism and bias against transgender people. Finally, the number of months suggested for sentences when a victim of a hate crime was described as a transgender Asian man was found to be lower when participants had higher scores for Hostile Sexism (r(51) = -.38, p < .001).

In the US, there has been a history of stigma against transgender people, even extending into the Diagnostic and Statistical Manual of Mental Disorders diagnosing being transgender as a mental disorder until 2013 (Hughto et al., 2015). Although transgender people are able to become more open, they are more exposed and still face stigma, discrimination, and hate crimes (Hughto et al., 2015; McKay et al., 2019). The difficulties transgender people face are still prevalent. An estimated number of 2115 transgender people were killed between 2008 and 2016, with many cases that may go unreported due to various reasons such as those who report the deaths do not have an option to report the transgender identity and other situations in which the individual may not be able to be identified as transgender or the perpetrators intentions can be difficult to determine (Dinno, 2017; Winter et al., 2016). Discrimination and violence is prevalent against transgender people with 78% transgender people in a study experienced harassment, 35% experienced physical assault (James et al., 2016), and review of anti-transgender violence found a range of 33 to 53% for physical assault (Hughto et al., 2015; Stotzer, 2009). Another study found 83% and 36% of transgender people experienced verbal and physical victimization, respectively, because of their identity (Clements-Nolle et al., 2006). Literature provides evidence for the stigma, discrimination, violence, victimization, abuse and hate-crimes that occur, which can result in harming the mental health of the individual (Winter et al., 2016).

A factor that is a result of a negative societal view and behaviors against transgender people is the high rate of attempted suicides at 41% which is much greater than the rest of the US population (Winter et al., 2016). A 2015 US survey reported 35% of transgender people experienced serious psychological distress (James et al., 2016). Following gender minority stress, which was based on Meyer's minority stress model to be adapted to transgender and gender-nonconforming people, the negative mental health outcomes that transgender people may have are related to the stressors they may face (Testa et al., 2015). The symptoms Testa et al. (2015) in their study were anxiety and depressive symptoms being related to stressors in their Gender Minority Stress and Resilience measure. At a greater risk than non-transgender people, transgender people are more likely to experience major depression (Nuttbrock et al., 2014), "anxiety, somatization, and overall psychological distress" (Bockting et al., 2013). Bockting et al. (2013) found stigma being related to this psychological distress.

Research has shown what factors may predict anti-transgender attitudes, sentiment and violence. Hill and Willoughby (2005) found that genderism and transphobia were associated with hate crimes, or gender-bashing, "assault and/or harassment of persons who do not conform to gender norms". Across much of related literature, this adherence to gender norms has been associated with hate crimes and negative attitudes towards transgender people. Belief in traditional gender roles were found to be associated with negative attitudes toward transgender people and transphobia (Harrison & Michelson, 2019; Nagoshi et al., 2008; Norton & Herek, 2013; Prusaczyk & Hodson, 2019). Similarly, gender essentialism is associated with negative transgender attitudes (Axt et al., 2021). In addition to the study by Axt et al. (2021), they found that "implicit transgender attitudes predicted meaningful outcomes, including transphobia, public policy support, interest in romantic relationships, prior contact, and general gender-related beliefs such as sexism and gender essentialism" (Axt et al., 2021). In particular, much of what has been found regarding these associations are that there is a link to cisgender men. The majority of hate crimes towards transgender people and hate crimes in general are perpetrated by men (Roxell, 2011; Wilchins & Taylor, 2006). In general, men are also more likely than women to have negative attitudes towards transgender people (Harrison & Michelson, 2019; Norton & Herek, 2013). A study by Harrison and Michelson (2013) found a factor in negative attitudes toward transgender people. Men were overall generally less supportive of transgender rights, but when the men in their study felt their masculinity to be threatened or men whos' gender was essential to their identity, were even less supportive. Nagoshi et al. (2008) hypothesized that men's anxieties about their masculinity can arise from the existence of transgender people because they violate the traditional gender norms, in which the anxieties become transphobia. It appears that threats to masculinity are at the basis of what may elicit much of the anti-transgender attitudes and behaviors. This masculinity threat can be understood in the integrated threat theory, a threat to conservativism, where traditional gender role beliefs can be held (Rye et al., 2019). Additionally, other literature has found associations between conservativism and negative attitudes towards transgender people (e.g., Harrison & Michelson, 2019; Prusaczyk & Hodson, 2019; Wang-Jones et al., 2017).

In the US, people of Asian descent residing in the US have faced stigma, discrimination, prejudice, and hate-crimes (Gover et al., 2020). Certain incidents in US history include Japanese concentration camps and SARS in 2003 (Eichelberger, 2007; Person et al., n.d.). Recently, COVID-19 pandemic has led to an increase of hate crimes committed against Asian-Americans, along with an increased Anti-Asian sentiment and discrimination (Dhanani & Franz, 2020). This could be a result of certain COVID-19 pandemic rhetoric that centers the virus and pandemic around China and people of Chinese descent (Gover et al., 2020). Even though the rhetoric is primarily about China,

the negative attitudes and behaviors have also been directed towards people of East Asian descent (In Stop AAPI Hate's first week, Asian Americans report over 650 incidents of verbal harassment, shunning and physical assault, 2020).

As a result of the stigma, prejudice, discrimination, and hate-crimes, an increase in poor mental health has been present (Campbell & Ellerbeck, 2020). In a study by Lee et al. (2021), the increased discrimination predicted several poor mental outcomes including anxiety, depressive symptoms, and sleep difficulties. Hate crime victims can "experience more severe consequences", in which they can become more fearful with intrusive thoughts (Gover et al., 2020).

For much of the anti-Asian sentiment, it is influenced by COVID-19 pandemic rhetoric used within the US (Gover et al., 2020). It centers the virus around China, such as "China virus" being used by the previous president, Donald Trump among many other people (Gover et al., 2020). Much like previous pandemics, the names given to viruses have influenced people in a way that may incite fear and stigma towards a group, due to being made associated with viruses or diseases, such as "Spanish flu" and "gay-related immune deficiency" (Hoppe, 2018; Kim & Shah, 2020). Researchers have applied the othering theory to the anti-Asian American situation in the US, in which Asian-Americans are othered and blamed for the pandemic (Gover et al., 2020). This could be understood as an act that not only affects the direct victim, but also towards other Asian-Americans, as a way to other this group as a whole. The justification-suppression model (Crandall & Eshleman, 2003) could be applied to this situation. The hate crimes and discrimination could be understood as perpetrators justifying their actions as they may perceive Asian-Americans as a foreign threat (Kim & Shah, 2020). Along with this perception and associations between the virus and people of Asian descent, expression of this prejudice and perception of a justification may be present.

Transgender Asian-Americans (TAA) have both the identities of being transgender and Asian-American, in which following the theory of intersectionality, the experience of discrimination is additive (Jefferson et al., 2013). Transgender people of color (POC) experience the most severe discrimination (Winter et al., 2016). As a result of this, TAAs may experience more severe discrimination than cisgender Asian-Americans and non-POC transgender people. Due to the discrimination they may face by being transgender and a POC, they are at increased risk of a negative effect on their mental health (Sutter & Perrin, 2016), including depression symptoms (Jefferson et al., 2013).

Although there have been studies on transgender people, transgender POC, and Asian-Americans, none have exclusively studied attitudes towards transgender Asian-Americans. As far as I am aware, there has been a lack of studies utilizing an IAT to examine implicit attitudes exclusively towards Asian-Americans and transgender POC. My study will take an approach to applying TAAs as the main focus in the IAT, in which implicit attitudes towards this group will be examined. This is important to examine because of the increase in prejudice against Asian-Americans and the existing prejudice against people who are transgender. TAAs may be at an increased risk of prejudice due to both their identities. In my study, I hypothesize that higher levels of implicit bias against TAAs than cisgender Asian-Americans will be present. Following previous research, I predict that men

and those who align politically conservative will express greater implicit bias against TAA. A vignette describing events of hate crime directed towards TAAs will be used. In addition to my hypotheses, I predict that men and those who align politically conservative will express greatest bias against TAAs. People who align politically conservative have generally recommended longer sentencing, but it has been shown that this is not the case when the victim is gay (Tomei et al., 2020). Much like this, I predict a similar finding would be found in regards to when TAAs and Transgender people are the victim. Following the justification-suppression model (Crandall & Eshleman, 2003), the participants that may hold a prejudice may be more likely to express it as the study is anonymous.

These are my hypotheses:

H1: There will be correlations between ambivalent sexism and transgender attitudes.

H1a: Higher scores on Transgender Attitudes and Beliefs Scale (greater bias) will be associated with higher scores on the Ambivalent Sexism Inventory (Hostile Sexism Subscale and Benevolent Sexism Subscale scores).

H2: On the Hate crime vignette, shorter sentences will be found for crimes against transgender Asians than others.

H2a: Perpetrator of Transgender Asian victim will have smaller discrepancies compared to either transgender or Asian victims.

H2b: Compared to gay victims, perpetrator of transgender and transgender Asian victims will have smaller discrepancies.

H3: Bias against TA group will be found on the IAT.

H3a: Relevant words ("dirty", "unnatural") will be responded to faster when Transgender Asian and "Bad" are together, as shown by higher (positive) difference scores.

H3b: Difference scores on the IAT will be correlated with other measures of bias (ASI, TABS).

H4: Ratings indicating more conservative political ideology will be associated with higher scores on Transgender Attitudes and Beliefs Scale, Ambivalent Sexism Inventory (Hostile Sexism Subscale and Benevolent Sexism Subscale scores), and express bias in IAT towards transgender Asians.

Methods

Participants

A convenience sample was gathered (N = 256). Participants were recruited through the psychology department subject pool by means of Sona. Although participants were recruited through the psychology department subject pool, not all students may be majoring

in psychology. All participants are undergraduate students ages 18 years or older attending California State Polytechnic University, Pomona. Participants received compensation through Sona credit.

Measures

A text-based Implicit Association Test (IAT; Greenwald et al., 1998) was developed to measure implicit attitudes. The IAT was developed through iatgen (Carpenter et al., 2019) by means of their browser-based Shiny application. Information presented to the participants was entered into this application and the software automatically built an IAT for Qualtrics and could analyze data I will obtain from the IAT. The IAT included positive attributes and negative attributes, which were good words ("Cheer," "Natural," "Healthy," "Friend," "Clean," "Happy," and "Safe") and bad words ("Dirty," "Unnatural," "Evil," "Disease," "Wrong," "Poison," and "Dangerous"), respectively. The target words were transgender Asian ("Trans," "Vietnamese," "Chinese," "Non-binary," "Gender-fluid," "Japanese," and "Thai,") and white man ("Male," "European," "British," "Scottish," "Masculine," "Cisgender," and "Swedish,").

A hate crime two-step jury instruction vignette from Cramer et al. (2010) modified by Cramer et al. (2013) was used (see Appendix A). I further modified this two-step jury instruction vignette for the purpose of this study. The years in the vignette were made to be more recent. The name of the victim was removed and a new set of reasons for the hate crime were listed. In step one, demographic information about the perpetrator and victim were provided, as well as a description of the perpetration of the 2nd degree murder. Sentencing information on 2nd degree murders were provided, as well as instructions for the participant to suggest a sentencing in years and months. Step two contains additional information, indicating it being a hate crime against either a transgender Asian man, transgender man, Asian man, or gay man. Sentencing information for a hate crime based 2nd degree murder is included and like in step two are asked to suggest a sentencing for the perpetrator.

The Ambivalent Sexism Inventory (ASI), developed by Glick & Fiske (1996), was a 22-item scale ($\alpha = .86$) used to measure overall sexism, consisting of two 11-item subscales measuring hostile sexism ($\alpha = .86$) and benevolent sexism ($\alpha = .76$; see Appendix B). Participants were asked to indicate the degree to which they agree with a particular item. There were six levels of agreement (0 = disagree strongly, 1 = disagree somewhat, 2 = disagree slightly, 3 = agree slightly, 4 = agree somewhat, 5 = agree strongly). Six items were reverse coded. A sample item for hostile sexism included, "When women lose to men in a fair competition, they typically complain about being discriminated against." A sample item for benevolent sexism which is reverse coded included, "Men are complete without women." Higher scores indicate a greater degree of sexism.

The Transgender Attitudes and Beliefs Scale (TABS), developed by Kanamori et al. (2017), is a 29-item scale ($\alpha = .94$) designed to measure attitudes toward transgender people (see Appendix C). TABS consists of three subscales: interpersonal comfort (14-items), sex/gender beliefs (10-items), and human value (five-items). An item from the interpersonal comfort subscale, which is reverse scored, would include, "If someone I knew revealed to me that they were transgender, I would probably no longer be as close to that person." An item from sex/gender beliefs subscale would include, "If a transgender person identifies as female, she should have the right to marry a man." An item from human value subscale would include, "Transgender individuals are human beings with their own struggles, just like the rest of us." TABS is scored on a 7-point Likert scale (5 = disagree strongly, 4 = disagree somewhat, 3 = disagree slightly, 2 = agree slightly, 1 = agree somewhat, 0 = agree strongly).

Procedures

When the participants accessed the study page on Sona and signed up, they received access to the link to Qualtrics. Once the link was clicked, they were directed to the Qualtrics study. If the device accessing the Qualtrics study was compatible with the IAT, participants were first be presented a consent form. If the device was incompatible, such as a phone or tablet, a page appeared informing them of the incompatibility and were unable to participate in the study. These participants were able to access the link again on a compatible device. The consent form provided contact information of the primary investigator, faculty advisor, and the Office of Research and Graduate Studies. Information also included the purpose of the study, confidentiality, compensation, risks, and benefits. Participants were able to either provide their consent or not, after reading the consent form. If participants declined to consent, they were directed to a page where they were unable to proceed with the study and able to close the page. If consent wass given, they were permitted to proceed with the study.

Following the consent form, participants were tasked to respond to two separate scales. They were tasked to complete the 22-item ASI and the 29-item TABS. The scales were presented on two separate pages in a randomized order. Participants either responded to the ASI or the TABS first and then the other next. The order of the items within each of the scales were randomized, so each participant received items in a different order.

The IAT was presented after the ASI and TABS. Participants began with reading instructions on how to interact with the IAT and pressed a spacebar to begin. Only one out of four conditions were presented. The conditions varied in the location (left/right) of the targets and attributes. Within a condition, there were seven blocks of IAT trials. Between each block there was a pause in which the participants read the instructions and had to press space bar to begin the block. The pause between each trail was 250 ms. Once the space bar was pressed for the first block, the IAT began, in which they completed a set of 20 target trials. The next block presented the 20 category trials. Block three presented the practice set of 20 trials and block four presented the 40 critical trials of the combined categories. Block 5 began with reversing the target in 40 trials. Block six wase a combined practice of 20 trials and block seven was the critical 40 trials.

After completion of the IAT, participants read step one of the vignette. Participants were provided details and information on the victim, perpetrator, the crime, sentencing information and instructions. They were tasked to suggest a sentencing for the perpetrator. For the victim and perpetrator, only the name, age, and affiliation information to their work were provided in step one. In step two, which was introduced on the subsequent page,

provided additional sentencing information and instructions. The participant learned the 2nd degree murder was committed as a hate crime. Participants were presented either one of the three victim characteristics (transgender Asian man, transgender man, Asian man, or gay man). They were then tasked to provide an additional sentencing based on this new knowledge.

Demographic questions were presented to the participants after completing each step of the hate crime vignette. The demographic characteristics participants provided were ethnicity, transgender status, gender identity, sexual orientation, and political affiliation. Following the demographic questions, participants read the debriefing. The next page contained a list of mental health resources for participants. On the page after, participants were brought to the end of the study where they were thanked for their participation and informed is the study was over, in which they could close the page and leave the study.

During and after data collection, participants were compensated. Sona credit was provided to the participants as means of either extra credit or required credit for their courses. After data collection, a copy of the data was extracted from Qualtrics. The data from the IAT was sent to the Shiny application from iatgen for assistance in data analysis. The entire dataset from Qualtrics and iatgen were analyzed in SPSS (IBM Corp., 2020).

Results

Correlations are presented in Table 1. Pearson correlation coefficients were used for associations made among the measures used in the study. There were positive significant correlations found between the TABS and the HS, $r(254) = .63$, $p < .001$ (see Figure 1). TABS was also found to have significant positive correlations with the ASI and BS. Negative significant correlation found with the IAT and the ASI, $r(235) = -.27$, $p < .001$, HS, $r(235) = -.33$, $p < .001$, TABS, $r(235) = -.33$, $p < .001$, and political ideology, $r(234) = -.28$, $p < .001$. Positive significant correlation with political ideology were found on the ASI, $r(247) = .43$, $p < .001$, HS, $r(247) = .51$, $p < .001$, BS, $r(247) = .21$, $p < .001$, and the TABS, $r(247) = .51$, $p < .001$.

Figure 1

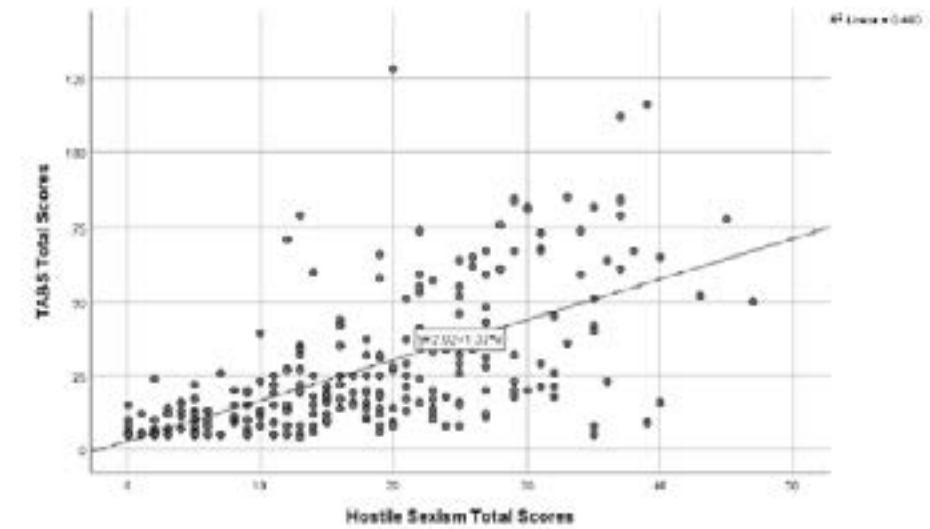*Association Between Hostile Sexism and Transgender Attitudes and Beliefs*

Figure 2

Associations Between Political Ideology and scores on Hostile Sexism and Transgender Attitudes and Beliefs
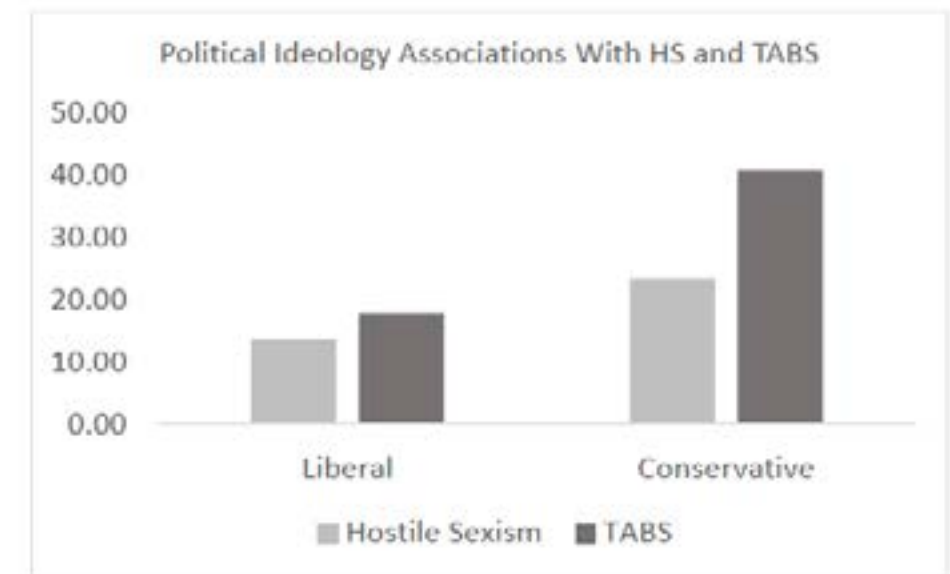
Table 1

Correlations for Study Variables

	1	2	3	4	5	6
1. Ambivalent Sexism Scores	.					
2. Hostile Sexism Scores	.88**	.				
3. Benevolent Sexism Scores	.83**	.47**	.			
4. Transgender Attitudes and Beliefs Scale Scores	.61**	.63**	.39**	.		
5. D-Scores	-.27**	-.33**	-.12	-.33**	.	
6. Political Leaning	.43**	.51**	.21**	.51**	-.28**	.

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

Greater scores on the TABS indicated greater anti-transgender bias. As scores on the TABS increased, so did the scores on the ASI, HS, and BS. This indicates that transgender attitudes andbeliefs are related to sexism as measured by these scales and subscales. Greater degree of anti-transgender bias was found to be related to greater levels of sexism. This was consistent withprior research that found that anti-transgender attitudes were related to sexism (Axt et al., 2021; Prusaczyk & Hodson, 2019).

No significant findings were found for the second hypothesis. It was not supported that recommended sentences for perpetrators of a hate crime toward a victim of a certain identity did not significantly differ from others. Perpetrators who committed the hate crime against a transgender Asian man victims did not significantly differ in recommended sentencing than the hate crimes committed against a transgender, Asian, or gay man. These findings were not consistent with the study by Cramer et al. (2013), where it was found that there were discrepancies found between transgender and gay victims.

The IAT was found to have inversed relations to the ASI, HS, TABS. Lower scores on the IAT indicate greater levels of anti-transgender implicit bias. Greater levels of anti-transgender implicit bias are related to sexism and anti-transgender bias measured on the self-reported TABS. Implicit anti-transgender bias was also found to be related to conservative political ideology. Consistent with Axt et al. (2021), it was also found that implicit transgender attitudes were related to sexism.

Ratings that indicated more conservative political ideology were found to be associated with greater scores on the ASI, HS, BS, and the TABS. Conservative political ideology was related to sexism and self-reported anti-transgender bias. This was consistent with various research findings about anti-transgender attitudes and sexism being related to conservatism (Harrison & Michelson, 2019; Prusaczyk & Hodson, 2019; Wang-Jones et al., 2017). This may be because connectivism consisting of traditional gender role beliefs (Rye et al., 2019).

Limitations

Several limitations in the study were found. The sample consisted entirely of undergraduate students. This sample may not be able to be generalized beyond the students at that university. Although this is true, it can be used as a good tool at understanding the attitudes belonging to the campus.

Another limitation would be the amount of participants who selected 'woman' as their gender identity. Around 70% selected 'woman'; not as much or enough results were able to be obtained from 'men' and other gender groups.

A final limitation would be regarding the hate crime vignette. It is unclear how the hate crime recommended sentencing in this study compares to actual hate crime trials. The sentencing that people would recommend in a real trial may reveal different and possibly significant results. The vignette in this study may have not elicited strong enough reactions that a real situation might provide.

Directions for Future Research

For future research, this study could be expanded in a way that broadens the study of attitudes toward other groups at an intersectional level. Observing the attitudes toward transgender people of different ethnicities and how these attitudes compare. In a follow-up study, it could compare the attitudes towards varying intersections between each other. Further research could also examine attitudes toward various gender non-conforming identities. Intra group bias could also be examined, focusing more on attitudes from within that group. Specifically with white transgender individuals' attitudes on transgender people of color at varying intersections similar to this study.

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Appendix A

Two-Step Vignette Methodology

This is the sentencing phase of Morgan Jones, case # 12517. Mr. Jones has already been found guilty of 2nd degree murder. The only question before you, the jury, is to determine Mr. Jones's sentence.

Below are the details for the jury's consideration:

The Victim

• Mr. S [name withheld for privacy]

• 44 year-old male

• Professor of chemistry at the University of Miami since September of 2000

The Perpetrator

• Mr. Morgan Jones

• 40 year-old male co-worker of Mr. S's

On February 3, 2009 Mr. Jones arrived unexpectedly at the home of the victim, Mr. S, at approximately 7:30 p.m. After a short argument at the front door, Mr. S attempted to shut the door on Mr. Jones. Mr. Jones reportedly over-powered Mr. S and forced his way into the victim's home. As shown in the trial, Mr. Jones drew a gun from inside his coat and shot the victim twice in the chest.

According to witness testimony, Mr. Jones and Mr. S were professional colleagues, but not close friends. Several of the victim's family members and colleagues testified that Mr. Jones had never been to Mr. S's home. Before the night of the crime, Mr. Jones had verbally expressed dislike of the victim. Mr. Jones' background revealed no prior criminal record.

Sentencing Instructions:

Federal sentencing guidelines for 2nd degree murder suggest a sentence of 235-293 months (19 years, 7 months – 24 years, 5 months). Given the federal sentencing guidelines for 2nd degree murder, how many months or years would you recommend for the above crime? There is no minimum amount of time to assign. Please write your answer in the space below and indicate months/years. It is important that you use only the information provided in the case summary and on this sheet; please answer honestly.

Your recommended sentence: _____ (years) _____ (months)

Additional Sentencing Information

At his trial the perpetrator, Mr. Jones, a white male, testified that he was overcome by rage and targeted the victim because he was a transgender Asian-American/Asian-American/or gay male. Hence, the murder was a hate crime.

Sentencing Instructions:

Federal sentencing guidelines for hate crimes suggest an increase of 3 punishment levels. Therefore, federal sentencing guidelines for a 2nd degree murder hate crime suggest a sentence of 324-405 months (27 years, 0 months – 33 years, 9 months). Given the federal sentencing guidelines for a 2nd degree murder hate crime above, how many months/years would you recommend for the above crime? There is no minimum amount of time to assign. Please write your answer in the space below. It is important that you use only the information provided in the case summary and on this sheet; please answer honestly.

Your recommended sentence: _____ (years) _____ (months)

Appendix B

The Ambivalent Sexism Inventory (ASI)

Below is a series of statements concerning men and women and their relationships in contemporary society. Please indicate the degree to which you agree or disagree with each statement using the following scale: 0 = disagree strongly; 1 = disagree somewhat; 2 = disagree slightly; 3 = agree slightly; 4 = agree somewhat; 5 = agree strongly.

B(I)_ 1. No matter how accomplished he is, a man is not truly complete as a person unless he has the love of a woman.

H___ 2. Many women are actually seeking special favors, such as hiring policies that favor them over men, under the guise of asking for "equality."

B(P)* 3. In a disaster, women ought not necessarily to be rescued before men.

H___ 4. Most women interpret innocent remarks or acts as being sexist.

H___ 5. Women are too easily offended.

B(I)* 6. People are often truly happy in life without being romantically involved with a member of the other sex.

H*__ 7. Feminists are not seeking for women to have more power than men.

B(G)_ 8. Many women have a quality of purity that few men possess.

B(P)_ 9. Women should be cherished and protected by men.

H___ 10. Most women fail to appreciate fully all that men do for them.

H___ 11. Women seek to gain power by getting control over men.

B(I)_ 12. Every man ought to have a woman whom he adores.

B(I)*13. Men are complete without women.

H___ 14. Women exaggerate problems they have at work.

H___ 15. Once a woman gets a man to commit to her, she usually tries to put him on a tight leash.

H___ 16. When women lose to men in a fair competition, they typically complain about being discriminated against.

B(P) 17. A good woman should be set on a pedestal by her man.

H*_ 18. There are actually very few women who get a kick out of teasing men by seeming sexually available and then refusing male advances.

B(G) 19. Women, compared to men, tend to have a superior moral sensibility.

B(P) 20. Men should be willing to sacrifice their own well being in order to provide financially for the women in their lives.

H*__ 21. Feminists are making entirely reasonable demands of men.

B(G) 22. Women, as compared to men, tend to have a more refined sense of culture and good taste.

Note. Copyright 1995 by Peter Glick and Susan T. Fiske. Use of this scale requires permission of one of the authors. A Spanish-language version of the ASI is available from the authors. H =

Hostile Sexism, B = Benevolent Sexism, (P) = Protective Paternalism, (G) = Complementary

Gender Differentiation, (I) = Heterosexual Intimacy, * = reverse-scored item.

The ASI may be used as an overall measure of sexism, with hostile and benevolent

components equally weighted, by simply averaging the score for all items after reversing the

items listed below. The two ASI subscales (Hostile Sexism and Benevolent Sexism) may also be

calculated separately. For correlational research, purer measures of HS and BS can be obtained

by using partial correlations (so that the effects of the correlation between the scales is removed).

Reverse the following items (0 = 5, 1 = 4, 2 = 3, 3 = 2, 4 = 1, 5 = 0): 3, 6, 7, 13, 18, 21. Hostile

Sexism Score = average of the following items: 2, 4, 5, 7, 10, 11, 14, 15, 16, 18, 21. Benevolent

Sexism Score = average of the following items: 1, 3, 6, 8, 9, 12, 13, 17, 19, 20, 22.

Appendix C

Transgender Attitudes and Beliefs Scale (TABS)

Interpersonal Comfort

Q1: I would feel comfortable having a transgender person into my home for a meal

Q2: I would be comfortable being in a group of transgender individuals

Q3: I would be uncomfortable if my boss was transgender (R)

Q4: I would feel uncomfortable working closely with a transgender person in my workplace (R)

Q5: If I knew someone was transgender, I would still be open to forming a friendship with that person

Q6: I would feel comfortable if my next-door neighbor was transgender

Q7: If my child brought home a transgender friend, I would be comfortable having that person into my home

Q8: I would be upset if someone I'd known for a long time revealed that they used to be another gender (R)

Q9: If I knew someone was transgender, I would tend to avoid that person (R)

Q10: If a transgender person asked to be my housemate, I would want to decline (R)

Q11: I would feel uncomfortable finding out that I was alone with a transgender person

Q12: I would be comfortable working for a company that welcomes transgender individuals

Q13: If someone I knew revealed to me that they were transgender, I would probably no longer be as close to that person (R)

Q14: If I found out my doctor was transgender, I would want to seek another doctor (R)

Sex/Gender Beliefs

Q15: A person who is not sure about being male or female is mentally ill (R)

Q16: Whether a person is male or female depends upon whether they feel male or female

Q17: If you are born male, nothing you do will change that (R)

Q18: Whether a person is male or female depends strictly on their external sex-parts (R)

Q19: Humanity is only male or female; there is nothing in between (R)

Q20: If a transgender person identifies as female, she should have the right to marry a man

Q21: Although most of humanity is male or female, there are also identities in between

Q22: All adults should identify as either male or female (R)

Q23: A child born with ambiguous sex-parts should be assigned to be either male or female (R)

Q24: A person does not have to be clearly male or female to be normal and healthy

Human Value

Q25: Transgender individuals are valuable human beings regardless of how I feel about transgenderism

Q26: Transgender individuals should be treated with the same respect and dignity as any other person

Q27: I would find it highly objectionable to see a transgender person being teased or mistreated

Q28: Transgender individuals are human beings with their own struggles, just like the rest of us

Q29: Transgender individuals should have the same access to housing as any other person

Note. R = reverse scored

Whisnant Angelica

The Milky Way Project: MOBStIRS (Mass-loss rates of OB Stars from IR bow Shocks)

Abstract

Infrared stellar wind bow shock nebulae are generated by the powerful stellar winds from massive stars (typically O- or early B-type stars) and the surrounding interstellar medium. Significant amounts of mass are lost through these stellar winds (10-7 to 10-4 solar masses per year); however, theoretical values for mass-loss rates can differ by an order of magnitude from those derived from various observational techniques. This project aims to measure size and shape parameters among the ~1000 known infrared bow shocks using the online Zooniverse platform, which enables "citizen scientists" to participate in research. The citizen scientists in this project (high school and college students taking general astronomy courses) will make drawings on bow shock images taken by the Spitzer Space Telescope. Each image will be measured by at least 20 different users. Reliability and uncertainty of the measurements of each image will be determined by analyzing the dispersion among different users' measurements. Compared to subjective measurements made by a few "expert" scientists, this system of data analysis allows for more unbiased results. The final values will help determine the true sizes and shapes of bow shocks and their inclination angles, which are necessary for deriving accurate mass-loss rates in the stellar winds of the driving stars.

Introduction

The most important feature of a star is its mass–it determines the luminosity, temperature, and eventual fate of the star after death. Because mass itself is such an important feature, the rate at which a star loses mass is also of importance. A star typically loses mass through its stellar winds, which is the outflow of ionized plasma from the star itself.

We focus on the massive O- and early B-type stars (OB type stars). Although they are relatively rare compared to lower-mass stars, these stars provide most of the light in star-forming galaxies, and explode as supernovae, which provide heavy elements and leave behind neutron stars and black holes. These massive stars tend to have much stronger stellar winds, blowing at >1000 km/s (Kobulnicky et al. 2018), and stars with stronger stellar winds lose a more significant amount of mass throughout their lifetime. Understanding more about mass-loss rates from the stellar winds of massive stars is crucial to understanding their life cycles and ultimate fates.

The rate at which a star loses mass can be studied through observations of infrared (IR) stellar wind bow shock nebulae (Kobulnicky et al. 2018). These types of bow shocks are created by the supersonic motion of two separate fluids, namely the stellar wind of the bow shock-driving star and the surrounding interstellar medium (ISM). Visually, these structures contain two main components: the driving star of the bow shock, and the arc created by the interaction of the star's powerful stellar winds with the ISM it moves through. The "apex" of the bow shock is the point on the arc closest to the driving star, and the "wings" are the part of the arc that flows on the sides of the driving star (Figure 1).
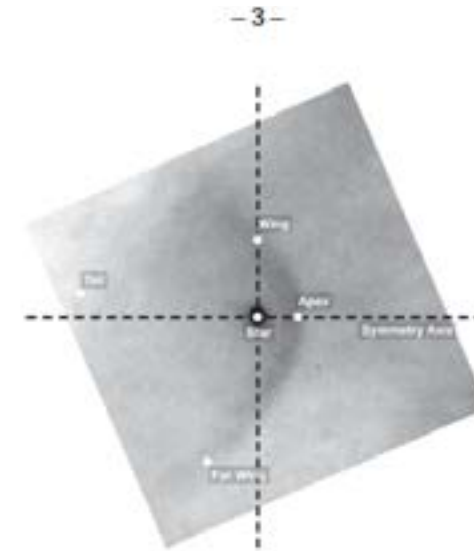

Fig. 1: Terminology to describe the parts of an IR bow shock. The point on the arc that is closest to the star is called the "apex" of the arc, while the sides of the arc are called the "wings" of the arc.

Reproduced from Tarango-Yong & Henney (2018)

stellar winds interacting with an outflow of gas from another source (Povich et al., 2008). Most IR bow shocks are formed by moving O- and B-type stars, many of which are moving at ~10 - 30 km/s (Kobulnicky et al. 2018), but can move at speeds as high as ~100 km/s (Fryer et al. 1998). The current known population of IR bow shocks stands at about 1000 (Kobulnicky et al., 2016).

To better understand the mass-loss rates of these stars, it's important to know the true shapes of the IR bow shocks formed by them. It has been found that the position of the bow shock-driving star can serve as a reference for describing bow shock shape. Wilkin (1996) developed a series of formulae for a bow shock shell's shape, mass column density, and velocity of the shocked gas, which can be used to obtain the parameters of bow shocks. The arc of IR bow shocks is formed from the points of pressure balance between the star's stellar winds and the ISM it travels through, therefore

$$\frac{1}{2}\rho_w V_w^2 = \frac{1}{2}\rho_a V_a^2$$

where ρ_w is the density of the stellar wind, V_w is the velocity of the stellar wind, ρ_a is the density of the ISM around the star, and V_a is the velocity of the ISM relative to the bow shock-driving star (Kobulnicky et al. 2010). The density of stellar wind is represented by

$$\rho_w = \frac{\dot{M}}{4\pi R_0^2 V_w}$$

(Kobulnicky et al. 2010). Rearranging the above equation, we have

$$\dot{M} = 4\pi R_0^2 \frac{V_a^2 \, \rho_a}{V_-},$$

where $\dot{M}$ is the mass-loss rate, and R_0 is the distance between the star and the apex of the arc.

As seen in the above equation, $\dot{M}$ is most dependent on the squared quantity, R_0. Knowing the R_0 shape parameter is therefore crucial in determining the mass-loss rate of a bow shock-driving star. This value shows the strength of the stellar winds of a star relative to the ISM it's traveling in–larger R_0 values indicate a larger mass-loss rate. However, the unknown inclination angles of these IR bow shocks on the plane of the sky present a problem, as inclination angle changes the apparent value of R_0. Tarango-Yong & Henney (2018) developed a general theory for the effect of inclination angle on the apparent shape of the IR bow shock, using ratios of planitude (flatness of the apex) and alatude (openness of the wings of the arc). These two ratios rely on the apparent values of R_C (radius of curvature at the apex), R_{90} (arc radius from the star, perpendicular to the symmetry axis), and R_0 (Figure 2). The overall trend of these ratios for various IR bow shocks can be analyzed to predict their shape as well as their inclination angle, and this can then be used to find the true shape parameters of these structures.
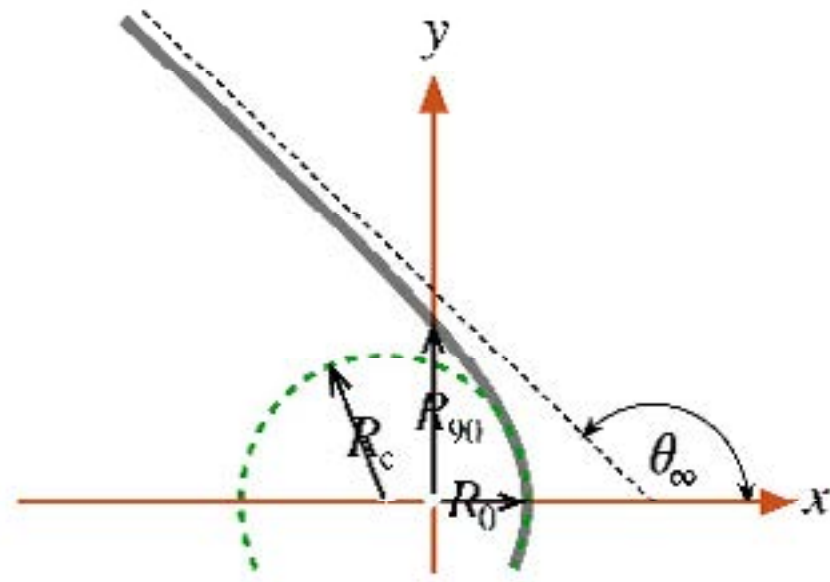
We use images from the *Spitzer Space Telescope* to create images of individual IR bow shocks to be measured by citizen scientists through the online Zooniverse platform.

2. Methods

The Zooniverse platform is being used to collect data. To test the website created for this project, it was given to Dr. Coral Wheeler's AST4250A course and Dr. Breanna Binder's AST1010 course in Spring 2022. The students were asked to complete measurements using the website, and provide feedback on their experience.

2.1. Zooniverse

Zooniverse has hosted many successful citizen science projects, and using citizen scientists for scientific research has been proven to be a reliable method of data collection (Cox et al., 2015, Watson & Luciano, 2018). This way of data collection is ideal for this project because of the large data set that needs to be sifted through–it's inefficient to ask only a few researchers to make measurements on all ~1000 IR bow shocks, when we have a citizen science platform that can enable hundreds of people to make measurements. Along with this, multiple people will measure one particular IR bow shock image. Some images are more "fuzzy" than others, so obtaining many measurements for each image allows for determining uncertainties, which is needed to better assess reliability–something that would be difficult to do with only a few astronomers. Creating an algorithm to record these measurements is a reasonable alternative suggestion to citizen science, but humans are much better at pattern recognition than an algorithm will be with our current technology. Henney et al. (2019) created an algorithm to make measurements on IR bow shocks, and it was noted that the algorithm favored certain parameter ratios and sometimes produced values

that were not accurate based on visual inspection. Along with the scientific advantages, using student citizen scientists can have positive educational impacts (Straub 2020).

This Zooniverse project was not made public because, although there are many images, this number is relatively small compared to the tens of thousands of images (or other forms of data, such as plots or audio) that other projects need to go through.

Images used for the Zooniverse website were created using the known IR bow shock positions and position angles of 590 IR bow shock nebulae from the catalog created by Kobulnicky et al. (2016). 174 of the IR bow shocks discovered through the Milky Way Project (Jayasinghe et al., 2019) were also used. The position angles of these needed to be recorded through SAOImage DS9, as it had not been done prior to this project.

Using the algorithm in Jayasinghe et al. 2019 (with some adjustments), images zoomed-in on each individual IR bow shock were produced from publicly-available, wide-field FITS image mosaics produced by the GLIMPSE and MIPSGAL surveys. The position angles were used to orient the images in a way so that the apex of the arc was at the top of the IR bow shock image. To account for possible asymmetry in the IR bow shock images, two versions of each IR bow shock were made: an "original" version, and a "flipped" version, where the image was flipped on its symmetry axis (Figure 3). Each driving star was marked by a "+" symbol, to ensure that students know where the star of interest is.
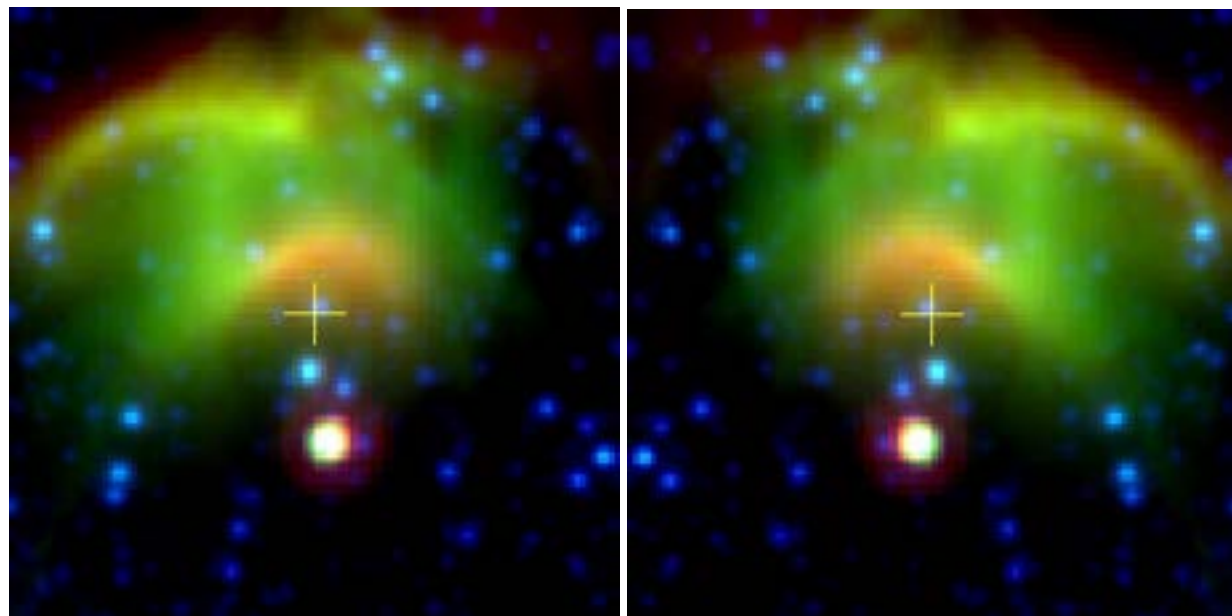

Fig. 3: The "original" image of an IR bow shock (left), and its "flipped" version (right).

The two parts of the website the users will most directly interact with are the "ABOUT" tab and the "CLASSIFY" tab. Because the website of this project is intended for general astronomy courses in high schools and colleges, the information presented on these parts of the website are tailored toward those with no or close to no knowledge in astronomy. The main purpose of the "ABOUT" tab (more specifically, the "Research" section, as shown in Figure 4) is to give the reader a general overview of the purpose of the project, while avoiding the usage of jargon–any technical terms that were used were defined. This part of the website does not go into too much detail, as students in general astronomy courses may not be as interested in the topic as advanced astronomy students or professional astronomers are.

Fig. 4: A screenshot of the "Research" section of the "ABOUT" tab, where most of the basic background information is provided.

In the "CLASSIFY" tab, the users click on "TUTORIAL" for a slideshow that gives details on how to complete each task (Figure 5). The Zooniverse drawing tools used for the measurements are the box tool (to measure R_0 and R_{90}) and circle tool (to measure R_c) (Figure 6). The box tool was chosen over the line tool because of the need for measurements of R_0 and R_{90} to be at a 90° angle, which is difficult to create freely by hand. There is also a confidence-level question a user will have to answer after each image they make measurements on. This can be used to better gauge how the users are feeling about a particular image, and will be very helpful in picking out "unusual" images (one population of images in particular being those with incorrect

orientation, in which accurate measurements will be impossible to make with the chosen Zooniverse tools). The steps on how to use each tool and draw each shape on the image were explained, and image and video examples were provided for further clarification. At the end of the tutorial, "special cases" (and examples of these cases) were included, to guide the user in making measurements in cases where they might find themselves unsure. These two cases are IR bow shocks with a double arc, and images that have multiple IR bow shocks in them.

Fig. 5: A screenshot of one of the tutorial slides, as seen by the user. This particular slide of the tutorial is describing how to use the "Radius of equivalent circle" tool to measure the R_c value.
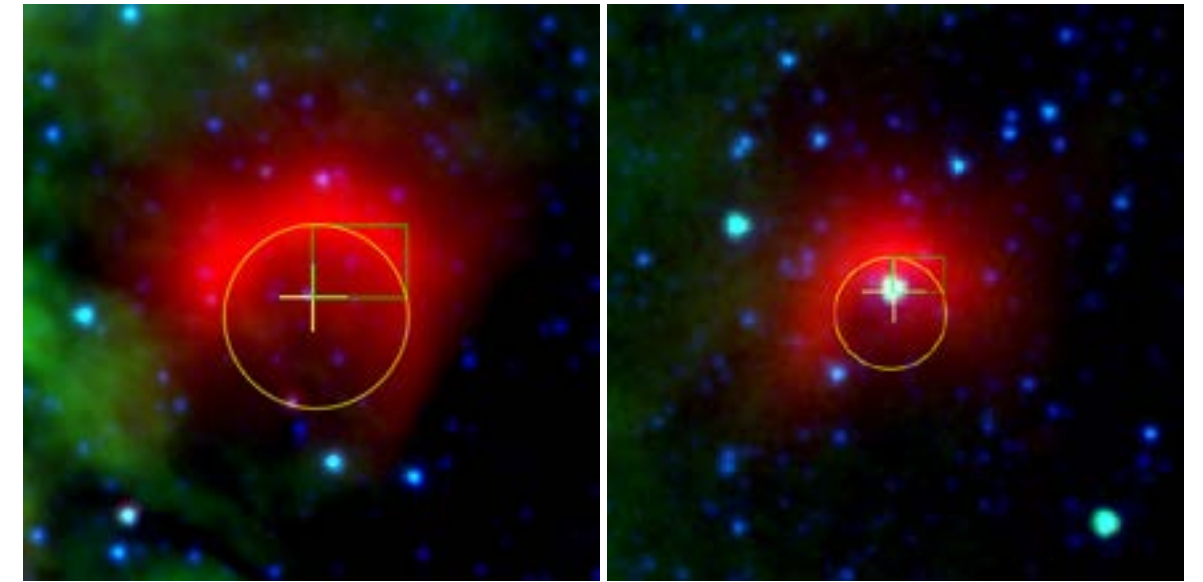

Fig. 6: Images of example measurements to be made by users using the Zooniverse tools. These examples were shown in the tutorial slideshow.

2.2. The Assignment

This project has been given as an assignment to two classes so far, to test the website for any issues. A short lecture was given before the students began making measurements. This lecture was a more detailed and technical discussion of the information included in the "ABOUT" tab, as the class consisted of advanced astronomy students. After the lecture was given, the students visited the website and started to make measurements using a training set, which is a set of pre-selected images of IR bow shocks with relatively well-defined structures. This was given to ensure that students knew exactly how to make the measurements, as these images would be relatively easy to measure. Questions asked by the students can be answered with more certainty for the training images, and will therefore be more effective in providing further clarity to students. The students were instructed to measure ~15 or more images in this set. They then continued to the main set of IR bow shock images. The students were asked to complete a Google Forms survey relating to the project after they have measured ~50 images.

3. Results

The Google Forms survey was separated into sections, each about the quality of the website: the "ABOUT" tab, "CLASSIFY" tab, and general feedback sections. Each section had three statements, of which the students would rate on a scale of 1-5 how much they agreed with the statements (1 being strongly disagree, 5 being strongly agree–smaller numbers are interpreted to be more of a "negative" response, and larger numbers to be more of a "positive" response). Each section was followed by a question asking students to type specific feedback in a textbox. Currently, 54 students have participated in the survey.

3.1. The "ABOUT" Tab

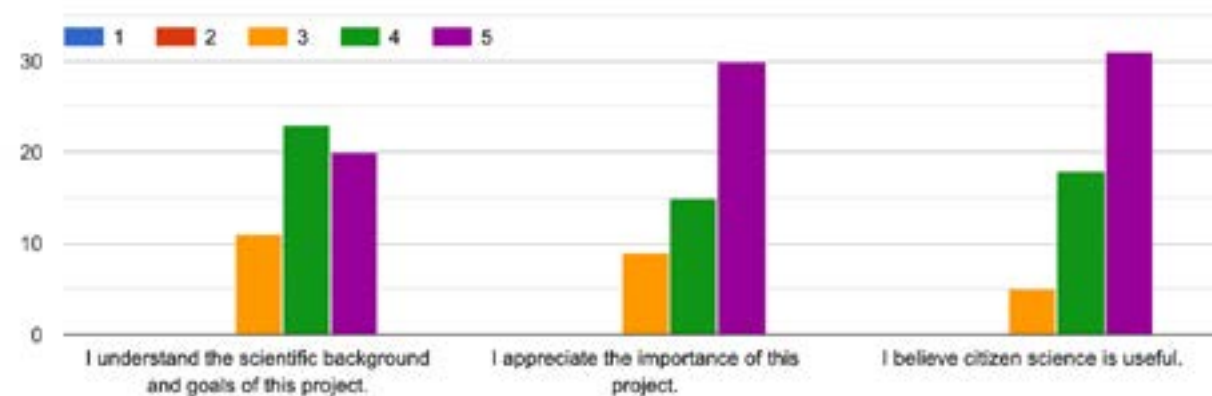Feedback on the background information (ABOUT tab) for the project

Fig. 7: A bar graph showing the ratings on the questions asked about the "ABOUT" tab of the project.

The results shown in the graph above seem to be more on the positive side. As for the typed comments on the "ABOUT" tab, most were positive. They indicated that this section was well-structured and did well to inform them of the topic. The few exceptions suggested more detail on the background of the project.

3.2. The "CLASSIFY" Tab

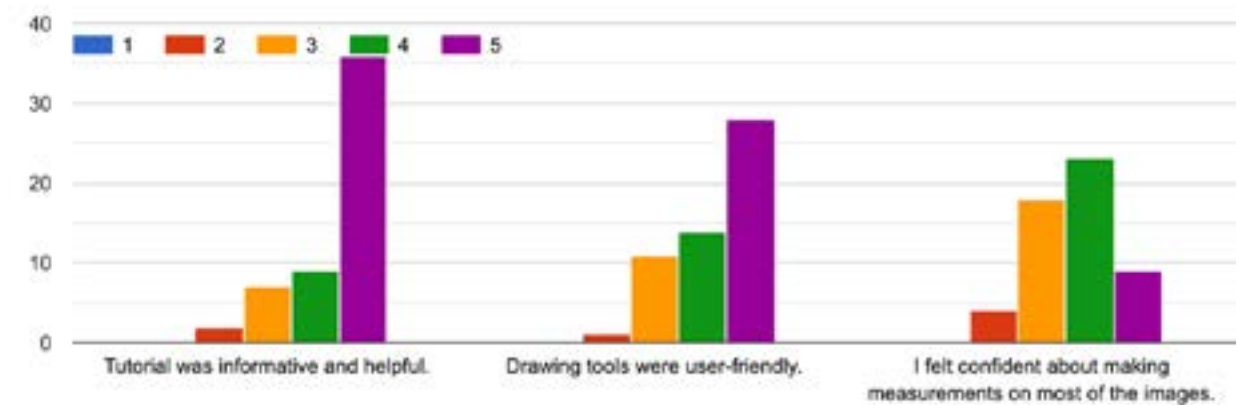Feedback on the classification tasks and tutorial.

Fig. 8: A bar graph showing the ratings on the questions asked about the classification tasks and tutorial of the project.

This graph overall shows a greater variability of answers compared to the previous one. Questions relating to the drawing tools and confidence of measurements had the most variability, with the question of confidence showing the more negative (although not completely negative) responses. Many of the typed comments on the classification tasks and tutorial commented on the difficulty and/or confusion with using the tools (for reasons of capability) or with working with the image presented to them (for reasons of incorrect image orientation). A few suggested more examples to be added to the tutorial.
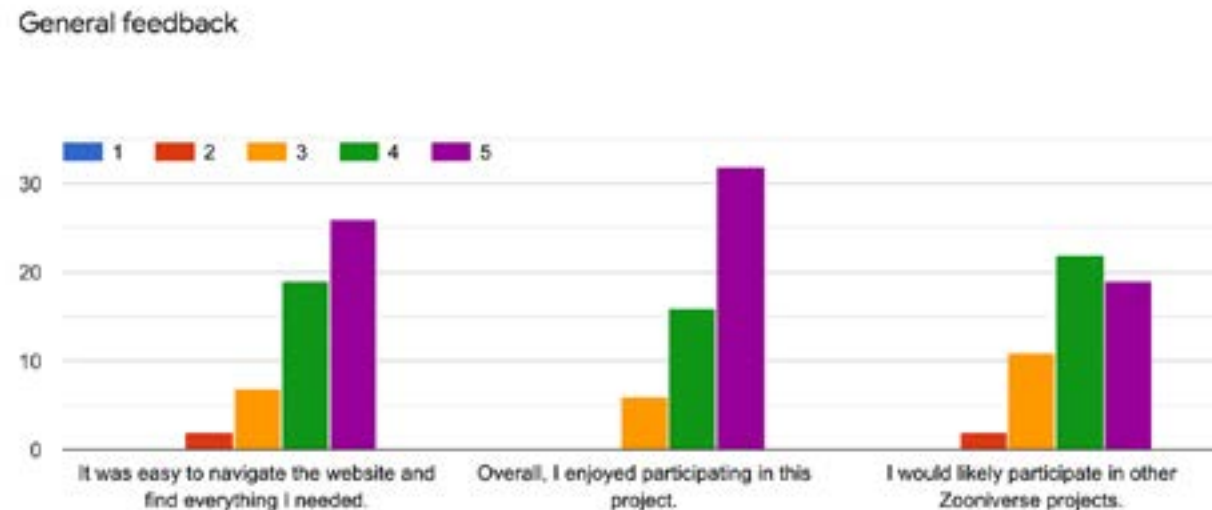
3.3. General Feedback

Fig. 9: A bar graph showing the ratings on general questions asked about the project.

There seems to be some variability with these results as well, but as with the previous graphs, the results are more on the positive side. Many of the typed comments in this section were positive, as for understanding how to participate in the project, as well as interest in the topic. Suggestions for improvements provided in this section was improving the ability to navigate the website, and linking past papers, or giving more detail, relating to the concepts of the project.

4. Discussion and Conclusion

The results of the survey seem to indicate a more positive attitude toward participating in this project. Overall, the questions on the "ABOUT" tab had the most positive responses.

As for the questions relating to the classification tasks and tutorial, there were issues with the tools and the images themselves. The tools selected to be used in this project were the ones that best fit the research goals, so it is not of much concern to improve this aspect of the project. As for the lower confidence levels of making measurements, this was to be expected, as the images were fuzzy and the wings of some IR bow shocks weren't visible on the side(s) of the driving star. There

can possibly be alterations to the algorithm that created the images to improve this, but it might not prove to be a significant improvement, if an improvement at all. Another difficulty with confidence of measurements mentioned in a few typed responses was the incorrect orientation of the images. Although we were aware of this beforehand, typed responses specifically about this issue show that there might be a significant amount of images that are tilted, which will give many incorrect measurements. This can either be due to the algorithm not orienting the images in the correct position, or incorrect position angles in the IR bow shock catalog. As a short-term response to this issue, there is added text to the slide in the tutorial regarding confidence level. The tutorial now specifically indicates that, if an image is either tilted or the wings do not show on the sides of the driving star, students should select "Not really" when asked if they are confident in their measurements. This will enable the website testers to help with identifying which images need our attention, as well as with diagnosing the problem.

The questions relating to the general feedback on the website were more on the positive side. A few comments mentioned difficulty with navigating the Zooniverse platform itself, but changing this is beyond our control. These comments, however, may indicate a need to focus more on the navigation of the website in future presentations.

Although the survey indicates the need for changes to different aspects of the project website, it also indicates that the main parts of the website seem to be doing well in fulfilling their purpose. Changes will be made to the website after the second testing phase is complete. The final results of the survey will provide further insight on the effectiveness of this project in producing reliable scientific data, and in enhancing the education of college students.

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Williams   **Sustainable Leather Alternatives: A Comparison of Cactus**
Sydney   **Leather Mechanical Properties**

Abstract

The purpose of this study was to evaluate sustainable leather as a footwear leather alternative. Using an experimental research design, four materials—two from the standard line and two from the recycled line—were sourced from the brand Desserto. Materials were examined by using mechanical testing that is typically conducted with natural leather. ASTM mechanical tests performed in this study included tensile strength, tongue tear strength, and colorfastness to crocking. Materials 1 and 4 were from Desserto's standard line and proved to have the best results for tensile and tongue tear testing. Materials 2 and 3 were from Desserto's recycled line and showed poor results in both strength tests in comparison to the other materials. Colorfastness results were consistent amongst every material. There was no color transfer from any material in wet or dry conditions. The findings of this study give insight into the performance of Desserto's sustainable leather materials for footwear product development.

Introduction

The global footwear market is a multi-billion-dollar industry. As of 2022, the footwear market amounts to roughly $488 million in revenue and is expected to grow by 7.65% annually. The footwear industry is currently shaped by customer purchasing habits (Statista, 2022). That said, it produces millions of tons of waste each year (US EPA, 2017). In particular, the footwear industry induces numerous environmental concerns, such as the use of hazardous chemicals, emissions, and solid waste created in the production process. Material selection influences the industry's effect on the environment. This is evident in parts of the industry that use leather for shoemaking. Natural leather is the most common material used in footwear because of its performance characteristics. Known for being durable, flexible, breathable, and stretchable, this material can conform to a wearer unlike any other (Motawi, 2018). Yet, because it is a byproduct of the meat industry, natural leather production has a substantial impact on the environment. Leather manufacturing typically requires the tanning process, which involves chromium, a toxic chemical, and a suspected carcinogen. That said, sustainability has become a priority for the footwear industry as there has been a greater demand for companies to use materials that are environmentally friendly (Grand View Research, 2020).

In 2020, the amount of footwear available in the United States and United Kingdom that was sustainable, or recyclable dramatically increased (Smith, 2022). This is a result of footwear manufacturers shifting toward the use of natural materials derived from plants (Asabuwa Ngwabebhoh et al., 2021). Material made from plants is cruelty free, climate friendly, and generally has a low impact on the environment. By using plant material, the leather making process involves cutting and cleaning plant leaves, mashing and drying them, then mixing it with non-toxic chemicals to create a desired finish. Sourcing from plants can produce a supply of raw materials that can be used in various areas of the fashion industry. However, this supply is finite depending on environmental conditions and the

water necessary to grow plants.

Research Purpose

This study evaluates the mechanical properties of different alternative leather materials created by Desserto (2022). Desserto is a sustainable leather brand that creates its products with cactus plants. Desserto does not use any form of irrigation, herbicides, or pesticides on their cactus plants. They leave the plant unharmed to allow repeated harvesting from the same plant. Desserto also prioritizes having no cross-industry conflict. The byproduct is directed to the food industry in an increased value form, which stimulates the agricultural sector to plant more cacti. Four different samples of Desserto cactus leather will be tested. Each sample will undergo weight, thickness, tensile strength, tear strength, and colorfastness to crocking evaluations based on American Society for Testing and Materials (ASTM) standards.

Literature Review

Leather in the Footwear Industry

Leather has been a staple in the fashion industry for decades. It is an agricultural by- product that has a variety of properties that makes it a desirable material (Asabuwa Ngwabebhoh et al., 2021). Typically seen in shoe uppers, leather is an ideal material for footwear because it is strong, breathable, abrasion resistant, thermal retaining, durable and elastic. Though it is capable of degrading, it takes about 50 years for the material to fully decompose because of the different chemicals and treatments used in processing (Nam & Lee, 2019). The slow decomposition process is not the only consequence of using leather. Leather footwear only accounts for 25% of global shoe production yet contributes between 30 to 80% of footwear impacts and affects ecosystem quality the most. One study investigating environmental impacts of one pair of shoes in varied materials found that leather shoes have the greatest global warming potential, energy use, water eutrophication, acidification, and photochemical ozone creation potential (Van Rensburg et al., 2020). All the negative impacts of leather footwear stem in leather processing.

Leather Processing

Leather processing begins by raising, then slaughtering cattle as the raw material for leather comes from its hides (Motawi, 2018). After acquiring the animal hide, the leather tanning process begins. Leather tanning prepares the raw material by removing hairs and curing it with salt and other treatments. The final step of the process is the use of chromium or vegetable tannins for the leather to achieve the aesthetic qualities. Raising cattle requires a large consumption of food, water, and land, which results in greater greenhouse gas emissions and other pollutants. Using chromium also releases chemicals and sulfates with carcinogenic properties into the air, which puts the environment and leather workers at risk (Van Rensburg et al., 2020).

Synthetic Leather Alternatives

Trends in sustainable fashion have caused footwear companies to transition to different materials. Synthetic leather is predicted to possess a global market worth of $85 billion dollars by 2025 (Asabuwa Ngwabebhoh et al., 2021). Synthetic materials have become popularized because they are more affordable and easier to process (Meyer et al., 2021). Affordability is one of many reasons why the fashion industry is transitioning to artificial leather. In addition, synthetic polymers enable high performance solutions that outperform leather for technical and design driven applications (Meyer et al., 2021). Polyurethane (PU) and polyvinyl chloride (PVC) are two synthetic materials that are commonly used in artificial leather. Though the materials are depicted as a sustainable substitution, PU and PVC have low biodegradability and are not easily recyclable because they are fossil based (Meyer et al., 2021). Challenges occur with the synthetic materials used for artificial leather due to different cross contamination of chemicals in processing (Asabuwa Ngwabebhoh et al., 2021). Thus, synthetic materials are not the solution to sustainable consumer demands, leading the industry to strategize alternatives.

Sustainable Leather Alternatives

Creating nature based, animal free fibrous materials, reducing nonrenewable-synthetic components, and replacing all fossil-based materials in coated textiles are current ideas being assessed in the industry (Meyer et al., 2021). Design of bio-based materials can be challenging when trying to guarantee that the material components are fully degradable. Bio-based materials describe materials that use biogenic raw materials instead of fossil fuels, coal, or petroleum to manufacture a variety of products (Meyer et al., 2021). Unexploited waste produced from food and agriculture processing have unlocked an unlimited supply of raw materials for the apparel industry (Asabuwa Ngwabebhoh et al., 2021). Cactus leather is a prime example of this. The sustainable alternative leather brand, Desserto, uses milled cactus leaves in replacement of synthetic components of artificial leather (Meyer et al., 2021). Cactus is a sustainable alternative because it has great carbon dioxide absorption capacity. According to Desserto (2022), their 14-acre cactus plantation absorbs 8,100 tons of carbon dioxide per year while generating about 15 tons annually. In a study comparing artificial leathers to natural leathers, Desserto was appropriate in its range of thickness for shoes, gloves, and apparel goods (Meyer et al., 2021). After mechanical testing, the Desserto leather showed the greatest tensile and tear strength results of all coated textiles included in the study. That said, the universal performance of mechanical testing for natural leather had the greatest results in comparison to all alternative leather materials.

Research Gap

There is a wide range of sustainable leather alternatives that have yet to be discovered. In this study, Desserto will be further investigated. There is little research on sustainable leather brands that use cactus plants like Desserto. Previously, some mechanical tests have been conducted on Desserto leather, but the testing only focused on one type of leather created by the brand (Meyer et al., 2021). Desserto produces four different collections of cactus leather including a standard, recycled, luxury, and temporary

lines that have a variety of backing materials and textured finishes. There is no research on the differences between these lines and how their material influences mechanical properties. Thus, the aim of this study was to evaluate differences among samples sourced to inform future footwear development.

Materials & Methods

Using an experimental research design, our focus was on examining the mechanical properties of cactus leather including weight, thickness, tensile strength, tear strength and colorfastness to crocking. The materials tested include four different cactus leathers by Desserto sourced from Mexico during January 2022 (Zapopan Jalisco, Mexico). Two materials were selected from Desserto's recycled line, and two were selected from the standard line. Three different material textures were evaluated. The backings were all knit materials and were combinations of polyester, cotton, recycled polyester, and recycled cotton. Testing was performed at Cal Poly Pomona in the Apparel Merchandising and Management building. During the time of testing, the room temperature ranged from 72-75 degrees Fahrenheit and 57% relative humidity. The following provides an overview of the material evaluations, there were three repeats for each test.

Weight (ASTM D3776)

This involved using a scale to measure the weight of 2 x 2-inch leather specimens in grams.

The weight was converted to ounces per square yard.

Thickness

Thickness was measured with a digital caliper.

Tensile Strength of Leather (ASTM D2209.18430)

The test specimen was cut into a dumbbell shape then clamped to the Instron testing grips. The force required to cause a rupture in the leather at a jaw of separation was measured. The Instron operated at a speed of 10 inches per minute until the sample tore. Tearing Strength, Tongue Tear of Leather (ASTM D4704.5674) The test specimen was cut into a rectangular piece of 4 x 1-inches. The thickness of the specimen was recorded. A 3/16" hole was punctured 1" from the edge of the specimen, the longer end of the specimen was then split down the middle in half. The halves of the specimen were clamped in each of the Instron testing grips along the long axis. The machine was operated at 10 inches per minute until the sample tore. Colorfastness to Crocking (ASTM D53053.7684) A test specimen of 8 x 3-inches was mounted flat and secured to the base of the crock meter in dry and wet conditions. A 2 x 2-inch white percale square was attached to the crock meter, then it was rubbed against the material for 20 revolutions. For the wet crocking test, the percale square was damp, and the same steps were repeated. Any color transferred to the square was

Colorfastness to Cracking (ASTM D53053.7684)

A test specimen of 8 x 3-inches was mounted flat and secured to the base of the crock meter in dry and wet conditions. A 2 x 2-inch white percale square was attached to the crock meter, then it was rubbed against the material for 20 revolutions. For the wet crocking test, the percale square was damp, and the same steps were repeated. Any color transferred to the square was assessed by comparison with the American Association of Textile Chemists and Colorists (AATCC) gray scale under a light box with sky light conditions.

Figure 1

Outline of fabric layout, used 9 x 9-inch piece of each material with 3 pieces for repeats
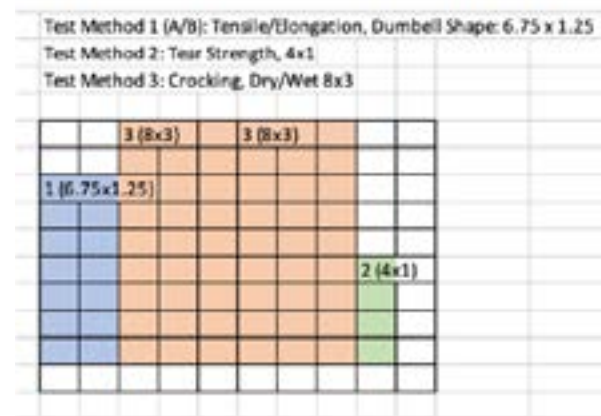

Figure 1 conveys the cutting layout for the tests. Characteristics of each material tested were recorded including photos of each material texture. Tensile strength data variables, breaking load (lbf) and elongation (in) were recorded based on key data shown on the Instron testing machine. With that data, elongation at break (%) was calculated. Tongue tear strength data was also collected using the Instron, only breaking load (lbf) was recorded. A crock meter was used to determine colorfastness of each material in wet and dry conditions. Results from crocking were evaluated using an AATCC gray scale. Photos of only one condition are shown because there was no difference in results for wet and dry conditions.

Results & Discussion

Material Description

As shown in Table 1, characteristics recorded included color, texture, backing fiber content, backing fabric structure, average thickness, and average weight. The weight of each material used in this study ranged from 19.25 to 25.48 oz/yd2; therefore, each material was classified as a very heavy weight fabric. Materials 1 and 2 had a thickness of 0.9mm, Material 3 had an average thickness of 1.2mm and Material 4 had a thickness of 1.0mm. Materials 1 and 4 were from Desserto's standard line and have the same backing fiber content of 65% polyester and 35% cotton. Materials 2 and 3 are from Desserto's recycled line. Material 2's backing fiber content is 50% recycled polyester 50% recycled cotton. It also is similar in weight to Material 1. Material 3's backing fiber content is 100% recycled

cotton. Material 3 has the greatest average weight across all materials. Materials 3 and 4 have the same leather texture, Rockport (Figure 2C and 2D). Material 1's texture is named Pampa Helen (Figure 2A) and Material 2's texture is named Freeport (Figure 2B). All materials have a knit backing fabric structure (Figure 2E).

Table 1

Description of Desserto Materials

Material #	Color	Texture	Backing	Backing type	Avg Thickness (mm)	Avg Weight (oz/yd^2)
1	Green	Pampa Helen	65% polyester/ 35% cotton	Knit	0.9	19.66
2	Ferrero	Freeport	50% recycled polyester 50% recycled cotton	Knit	0.9	20.08
3	Blue Navy	Rockport	100% recycled cotton	Knit	1.2	25.48
4	Black	Rockport	65% polyester/ 35% cotton	Knit	1.0	19.25

Figures 2A-E

Various textures described in Table 1. Images from a USB Digital Microscope

Figure 2A: Pampa Helen

Figure 2B: Freeport

Figure 2C: Rockport (Blue Navy)

Figure 2D: Rockport (Black)

Figure 2E: Knit Backing

Tensile Strength & Elongation

To examine tensile strength, elongation (in), breaking load (lbf), and elongation at break (%) were determined for each sample. Table 2 contains data on dumbbell leather specimen width, elongation, breaking load, and percentage of elongation. The width of each dumbbell leather specimen and its repeats ranged from 13.0mm to 14.3mm. Elongation data recorded for each material ranged from 2.19 to 2.71in. Materials 1 and 4 had breaking load data ranging from 30.11 to 35.38 lbf. Material 3 had breaking load data ranging from 20.97 to 22.10 lbf. Material 2 contained all outliers having elongation data ranging from 1.82 to 6.48in and breaking load data ranging from 9.64 to 18.56 lbf. Materials 1, 3, and 4 had a percent elongation ranging from 54.7% to 67%. Once again, Material 2 contained all outliers having a percent elongation range from 45.5% to 162%. Overall, Materials 1 and 4 conveyed the greatest strength across all samples. This result suggests that these materials can withstand more force before breaking. These two materials also share similar backing fiber content, which can explain why they had similar breaking load results. Material 2 shows a lot of variation thus, testing would need to be repeated to validate the outcome. Figures 3A and 3B visualize these results.

Table 2

Tensile Strength/ Elongation Results (Dumbbell Shaped Materials)

Material #	Dumbbell Midsection Width (mm)			Elongation (in)			Breaking Load (lbf)			Elongation at Break		
Repeat	1	2	3	1	2	3	1	2	3	1	2	3
1	13.8	13.2	14.3	2.31	2.52	2.26	30.11	34.59	30.79	57.7%	63.0%	56.5%
2	13.2	13.1	13.7	6.48	1.82	6.35	9.64	18.56	8.98	162%	45.5%	159%
3	13.7	13.0	13.2	2.65	2.71	2.68	21.97	20.97	22.10	66.2%	67.7%	67%
4	13.4	13.1	13.7	2.25	2.19	2.34	33.25	33.30	35.38	56.2%	54.7%	58.5%

To determine elongation percent, the following equation was used:

$$\% \ Elongation = \frac{Fabric \ extension}{distance} \cdot 100$$

Figure 3A

Bar graph of breaking load/ tensile strength results for each material and their repeats.
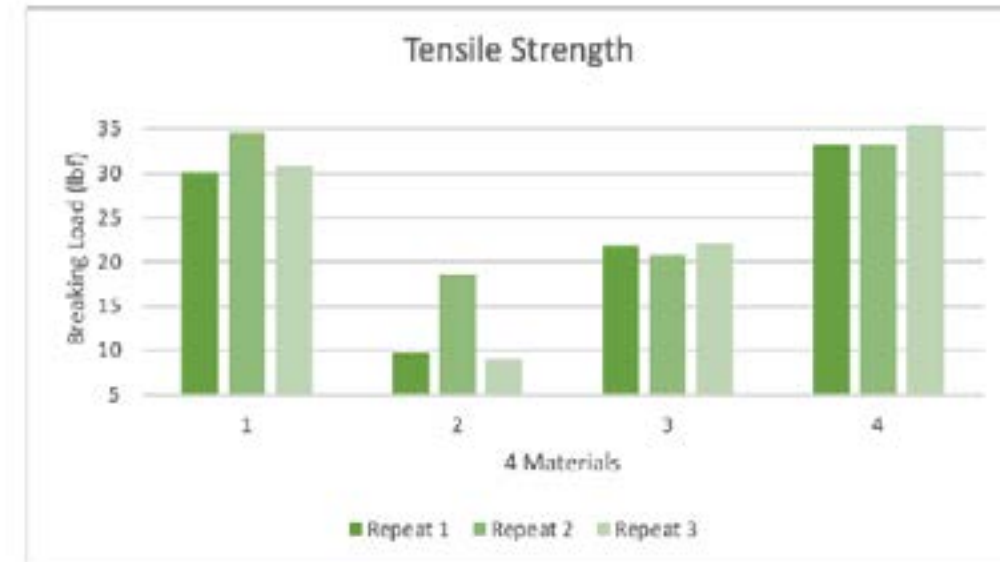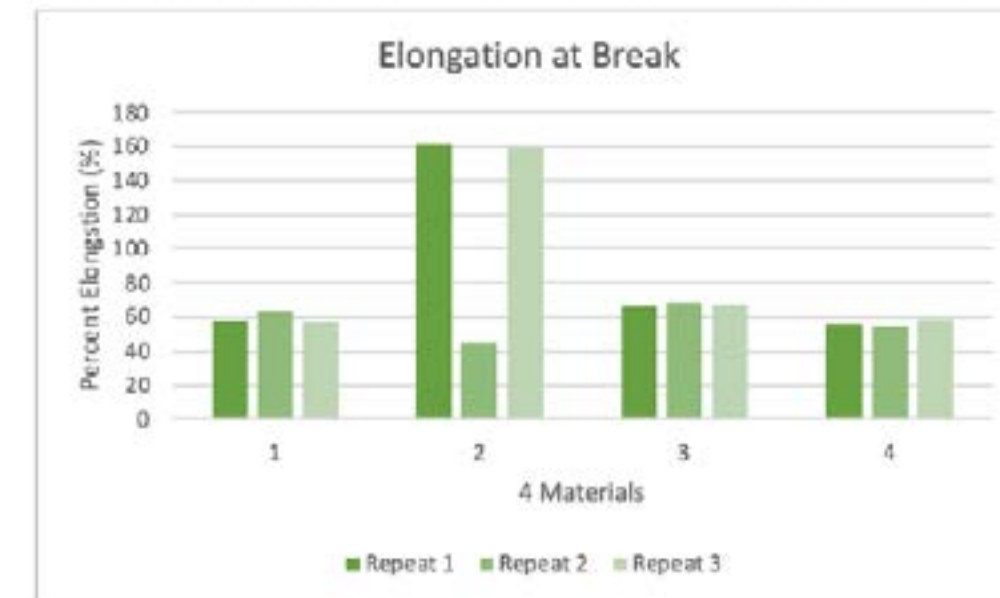

Figure 3B

Bar graph of calculated percent elongation at break results for each material and their repeats.

Tongue Tear Strength

To examine tear strength, the breaking load of the material must be measured with tensile testing equipment. Table 3 displays the results of the tongue tear strength test. Materials 1 and 4 showed similar results in breaking load. However, across each repeated sample, Material 4 showed variation ranging from 6.2 to 9.53 lbf. It is necessary to repeat testing procedures with Material 4 to confirm these results. Materials 2 and 3 are not the strongest materials in comparison to the other materials; however, both samples have consistent data across repeated test specimens recording breaking loads ranging from 3.97 to 4.99 lbf. Figure 4 provides further visualization. The tongue of a shoe is designed to withstand force as it typically gets pulled often by users. Considering this, Materials 1 and 4 would be utilized best in this part of a shoe.

Table 3

Tongue Tear Strength

Material #	Breaking Load (lbf)		
Repeat	1	2	3
1	9.04	9.72	8.9
2	3.97	4.83	4.02
3	4.60	4.83	4.99
4	9.53	7.68	6.20

Figure 4

Bar graph of breaking load during tongue tear
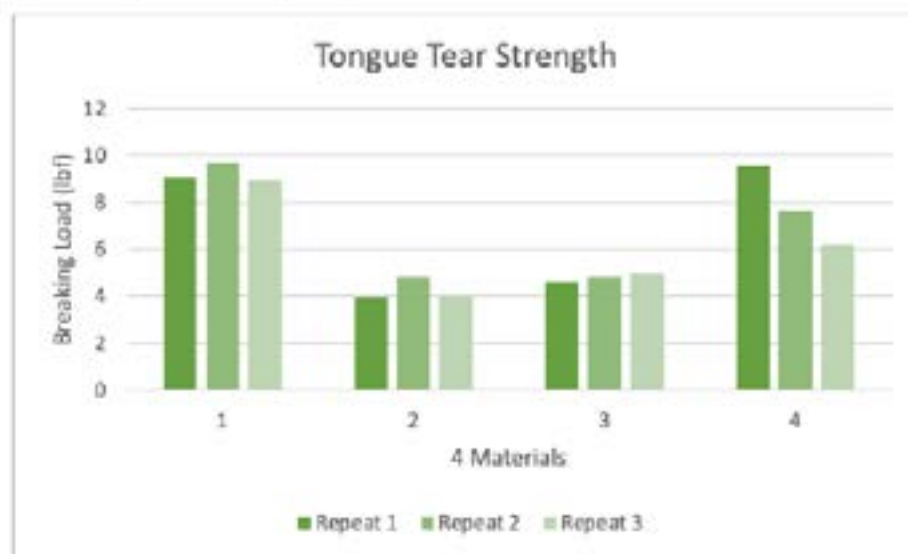
Colorfastness to Crocking

Colorfastness refers to a material's ability to retain color. To determine if a material is colorfast, a crocking test is completed to evaluate the amount of color transfer a material may have. Table 4 shows the results of wet and dry crocking assessments for each material using a gray scale made by the AATCC to evaluate the degree of staining. Each material and their repeats had the same score of a 5, which suggests no sign of color transfer. These results justify Desserto's (2022) catalog statement that says their materials are protected to not transfer color to other materials. The results are visualized in Figures 5A-D.

Table 4

Colorfast to Crocking Results

Material #	Average Dry Crocking Score	Average Wet Crocking Score
1	5	5
2	5	5
3	5	5
4	5	5

Figures 5A-D

Images of each material after undergoing crocking assessment and being compared to the

AATCC gray scale.

Figure 5A	Figure 5B	Figure 5C	Figure 5D
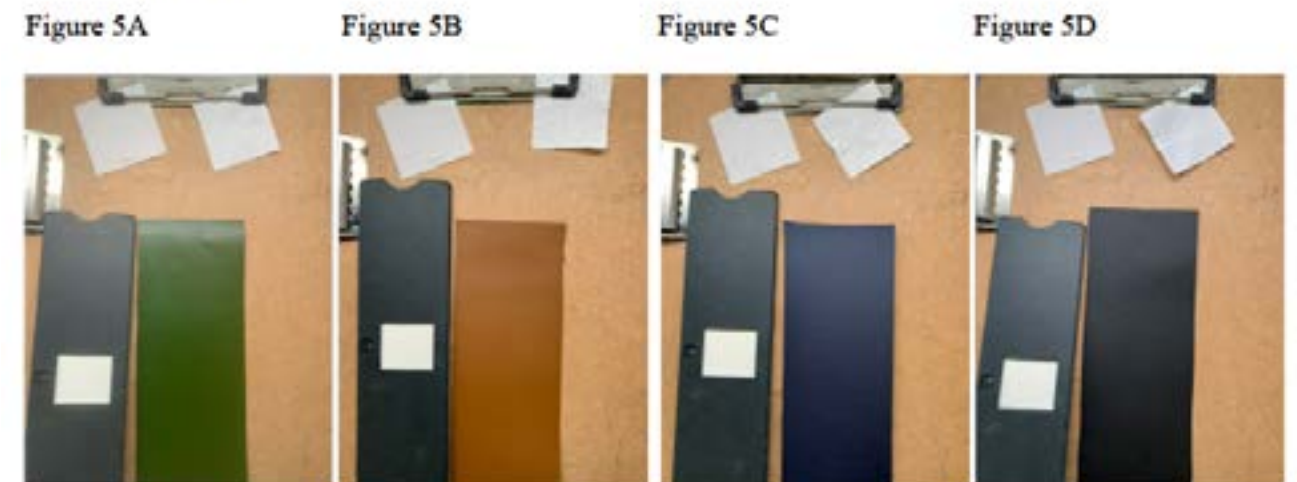
Discussion & Conclusions

Materials have a significant impact on the functional properties of different garments and goods. The materials used in this study are currently used in footwear. The significance of this research is to provide more literature about sustainable leather alternatives and study the different materials made by Desserto. With this in mind, mechanical properties of Desserto's materials were evaluated with mechanical lab tests. Tensile strength, tongue tear strength, and colorfastness of four different Desserto materials were evaluated. Materials 1 and 4 were from Desserto's standard line and proved to have the best results for tensile and tongue tear testing. Materials 2 and 3 were from Desserto's recycled line and showed poor results in both strength tests in comparison to the other materials. These findings are plausible because recycled materials are typically weaker than raw materials. Colorfast results were consistent amongst every material. There was no color transfer from any material in wet or dry conditions.

There were a few limitations in this study that could have affected the results of each mechanical test. Limitations in equipment had the greatest potential for skewed results. Tensile and tear strength testing require the use of special equipment. In this study, an Instron was used to evaluate materials. Seen the most clearly in Material 2's results for elongation, the Instron not detecting the initial break in material led to some outliers in the data. Other materials may have over stretched, which can also impact results and more repetitions of tests may be necessary. The materials were also not tested in a conditioned environment; therefore, results may vary.

For future research, it would be interesting to look at other sustainable leather lines within Desserto's brand. Comparing Desserto's leather to other sustainable leather alternatives with the same backing materials would be beneficial to analyze the difference between alternative leather types. To expand this research, more mechanical testing should be done. Additional footwear testing for leather can include bally flex endurance, waterproof absorption, wicking, and leather Mullen bursting to add to the literature for sustainable leather being used in footwear (Johnston & Murphy, n.d.). The study design and testing procedures used for Desserto's cactus leather can be useful for future researchers who wish to understand how mechanical testing can inform sustainable footwear material product development. A goal is to implement the cactus leather in footwear product development as a sustainable alternative to leather.

Acknowledgements

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The Critical Success Factors of Transfer Student Success at a
Four-Year University

Abstract

Based on an increased demand for a skilled workforce in Science, Technology, Engineering, and Mathematics (STEM), the United States established educational goals to increase the number of STEM graduates. In the U.S., approximately half of students in the STEM disciplines receive their bachelor's degree after transferring from a community college. The transfer students' academic performance (i.e., GPA, the two-year/four-year graduation rate, retention rate, and years-to-degree), is significantly affected by many factors, including sociocultural-, academic-, and environmental-factors. The primary objective of this study is to identify the transfer students' challenges for achieving their academic goals and expectations. In addition, the study created a survey questionnaire to assess the impact of the factors on transfer students' performance and success. Lastly, the survey from this study will identify an understanding of what further action a university can take to support and improve transfer students' success. To achieve the objectives, the research team conducted a literature review of the publications to identify prominent factors among transfer students. Then, the team developed a survey questionnaire to understand the transfer student's experience at a four-year institution and distributed it to transfer students at a four-year institution. The survey consisted of a set of questions covering the four different categories: demographic background information, academic performance, institutional experiences, and commitments and supports. Upon analyzing the data, the research team documents a list of CSFs for transfer students' success and demonstrates how the CSFs have affected transfer students' success at a four-year institution. Based on the research findings, the university can prioritize its resources to enhance transfer students' success and offer a new program to ensure transfer students' success.

Introduction

Community colleges attract many students because enrollment does not preclude living at home or concurrent employment [1]. Additionally, there has been an increase of students attending community colleges and transferring out to their desired university to continue their education and attain their bachelor's degree. Community colleges "play a substantial role in improving the production of STEM graduates" [2]. However, the acquired time that it takes a transfer student to complete their bachelor's degree has been approximately 2 to 4 years, plus the years they spent in community college. In the California State University (CSU) System alone, 40.4 percent of transfer students graduate in 2 years and 77.5 percent of transfer students graduate in 4 years [3]. Moreover, transfer students' academic performance (i.e., GPA, the two-year/four-year graduation rate, retention rate, and years-to-degree), is significantly affected by many factors, including sociocultural-, academic-, and environmental-factors. To identify the factors and challenges students face, a survey of questions was formulated to collect data on transfer students. These questions were formed in sections based on the success factor. Thus, the research team will continue analyzing the survey responses once the IRB (Institutional Review Board) approves the survey. The team will also identify the critical success factors that affect transfer students from achieving their academic goals and expectations. Our research findings will present that a university should prioritize its resources to enhance transfer students' outcomes and offer a new program to ensure transfer students' success.

Literature Review

To understand what factors, affect transfer student success a literature review was conducted and the critical success factors along with a description are summarized down below in Table 1. The purpose is to allow the audience to understand what is included under each factor and in this case, the most prominent factor in the literature review was environmental factor.

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Table 1 Summary of Critical Success Factors (CSFs)

No.	CSF	Description
1	Equity-related Factors	• returning adults • low-income students • first-generation students • women, and minority students from working-class backgrounds • nationality and citizenship status • students over 24 years old (encounter hurdles, self-directed, learning strategies and goal-oriented)
2	Sociocultural Factors	• students with college-educated parents (parental education) • educationally advantaged backgrounds • lower socioeconomic backgrounds • transfers from poor urban areas • family responsibilities • location of the community (area) • demographic overview • importance of being a community leader • community service participation • family and work obligations • create a supportive social relationship
3	Economic Factors	• number of hours worked per week • amount of financial aid received • financial concerns • required financial commitment • cost of attending • institutional and state resources, such as financial aid

No.	CSF	Description

4	Environmental Factors (institution-oriented)	• living or working off-campus
		• students witness and experience acts of discrimination on campus, including hostility and harassment
		• sense of belonging to the university and integration
		   o underprepared in a university setting, isolation, and anonymous feelings
		   o successful integration into the campus, living on campus
		   o integrate into the campus community by developing a network
		   o institution promoting or inhibiting student involvement, feeling of acceptance, and belonging in social and academic environment
		• attended a HSI (outside of the state of California)
		• creating programs, initiatives, dependable communication between transfer student and university
		• institutional characteristics (e.g., size of institution, research-focused mission, classes held in large lecture halls, and student body primarily full-time traditional age college students)
		• effective transfer partnership, collaboration, support from campus leaders, adequate funding, and a university presence at the community college
		• data sharing to monitor progress
		• excellent academic preparation (quality courses)
		• upper-division courses may help to reduce course overlap, improve time- and credits-to-degree among transfer students, and improve system efficiency
		• student demographics, high school achievement and quality, and some institutional inputs (i.e., size, faculty-to-student ratio, proximity to CSUs, and academic/occupational program mix) larger student populations and being located closer to a CSU
		• leave college prior to graduation (integration), academically competitive, benefit from student services and programs focused on retention and student engagement
		• articulation policy derailed by other institutional actors
		• structures, and policies that exert influence during implementation (overloaded technical majors in the first semester)

No.	CSF	Description
5	Environmental Factor (faculty/staff oriented)	• faculty-student interactions (relationship/time with a faculty member, mentor training for faculty) • time with academic advisor (Provide information need for their academic and job choices) • peer mentors (interaction with student peers) • create connections that benefit their future development • providing tailored transfer student advising • joint training for student advisors • faculty advisors and instructors monitor transfer student progress, sense of belonging
6	Academic Factors	• student outcomes (GPA, attendance/persistence/transfer rates) • student involvement in academics • enrollment intensity • aware of benefits in their persistence and educational attainment
7	Transfer process-related factors	• Transfer Associate Degree (TAD) policies, guarantee of credit transfer, induce students to earn a two-year credential due to the consistency of policy features • scholarship, and financial aid information • statewide virtual transfer credit system • decrease transfer credit loss • prevent the loss of credit when students transfer (articulation policies, prevent the loss of credits, evaluate the transfer or loss of credits applicable toward general education requirements) • institution-driven system college advisors provide incorrect course information due to university's degree program requirements is hard to find, does not exist, or is outdated • full transfer of credit, junior standing, credits completed • students attaining an associate degree, classes taken, credits earned • current course requirements and degree pathway • a policy perspective, pretransfer associate degree attainment and post transfer success • earning an associate degree before transferring is associated • prioritizing transfer and creating clear programmatic pathways with aligned high-quality instruction • specific coursework within a major, with no loss of credit • an electronic transcript system • the policy's impact on student transferability • structure, policies and processes, and the accessibility of the system • receive priority admission or consideration

Sociocultural and Equity Factor

There has been extensive research done to understand what factors are affecting transfer students' success. Upon doing our research, the authors found that sociocultural (i.e., family responsibilities, work obligations, community service participation) and equity (i.e., age, first-generation students, under-represented minority, international students) are student factors that impede transfer students' success [4]-[8]. Students who have other responsibilities besides school face an imbalance with trying to handle too many obligations at once that can affect their study time.

Previous studies identified that sociocultural obligations cause unsuccessful academic requirements to be fulfilled [6]. On the other hand, first-generation students face learning to navigate the college system on their own [4, 5], under-represented minorities and international students are challenged with accessing an equitable education [5, 7], and students with a wide scope of age range, struggle with college experiences or are more goal oriented [8]. Additionally, student equity layers into creating a barrier that setbacks transfer students from achieving their academic goals.

Economic Factor

Students often apply for financial aid and receive information to help with the cost of their education. However, many transfer students encounter economic-related issues (i.e., working on campus or off campus, number of hours worked, financial aid resources) that pulls them further from earning their bachelor's degrees. Studies show that the number of hours a student works in a week, and whether they work on campus, does influence transfer student success. Students who work on campus are more likely to interact with faculty and their peers, whereas students who do not, have a harder time integrating with the campus [4]. Additionally, the number of hours a student works varies on the students' circumstances. The more hours needed to work to afford school or external costs has an impact on a student's academic goals [7]. Furthermore, having access to financial aid resources and information helps alleviate financial concerns for transfer students [9]. Thus, economic factors weigh in greatly on transfer students being able to complete and obtain their bachelor's degree.

Environmental Factor

Transitioning from community college to a university setting is a drastic change that impacts every student differently. Therefore, understanding the environmental factors that play a part in transfer student success is critical in determining what changes the university can make to increase academic achievement. Our study distinguished, institution-related factors (i.e., sense of belonging, campus involvement, academic integration, overload of upper division courses, transfer credit loss) and faculty/staff-related factors (i.e., faculty-student interactions, faculty mentor, academic advising, monitoring transfer student progress) as two types of oriented environmental factors.

Students who are new to a campus try to find that sense of belonging and seek on campus involvement to feel part of a community. Universities that promote student involvement and having a peer mentor program enhances student retention [10]-[12]. This indicates that transfer students who feel a sense of belonging, integrate to their campus successfully academically and socially. On the other hand, high level courses that cause an overload may impact transfer students by having an unsuccessful academic and social integration on campus [13]. This causes a disadvantage for transfer students when transferring to a four-year university because they are more likely to take an overload of upper division courses due to completing all General Education requirements. This can result in students harming their GPA and on-campus involvement due to being unacquainted in taking high load courses.

In contrast, an issue that transfers students go through when transferring is credit loss. Meaning, courses taken at their community college that are meant to meet a requirement but do not successfully transfer or the course transfers to a different one than the intended course. In some cases, students that take courses intended towards their academic degree program does not transfer towards the program requirement, but towards an elective instead [14]. As a result, students endure having to retake the course again at their transfer university to fulfill their missing credits.

Interacting with faculty and staff is essential in building a professional relationship, network, and achieving academic goals. Students who attended their four-year university straight out of high school have enough time to form professional relationships with their professors within their first 2 years. Whereas transfer students are restricted with time and need to form professional faculty and staff relationships right away when they transfer to build their network. Spending time, interacting, and having a faculty mentor are beneficial to a student's future development and educational success [8]. In addition, spending time and interacting with academic advisors is significant in students continuing and staying on track of their degree program. Creating a supportive relationship, providing resources, and monitoring student progress improves transfer students' outcomes [8], [15]. Therefore, institutional and faculty/staff-oriented are environmental factors crucial to transfer students achieving their academic goals.

Transfer Factors

The transfer process requires guidance, commitment, and patience. Viewing transfer process-related factors (i.e., academic advising, transfer pathway, Associate Degree for Transfer, Associate Degree(s), transfer shock) assists with determining the affects it has on transfer student success. Before transferring students meet with their advisors to corroborate that their transfer degree pathway is being followed. These pathways entail requirements intended for the degree program at the community college and transfer university. Kicker's case study emphasizes that to establish an effective transfer partnership community colleges and universities must work together to sustain a working partnership [17, 19]. Studies show that if transfer policies implemented a system that accepts upper division courses, then transfer students would have a smoother transition [16]. Additionally, Associate Degrees and Associate Degrees for Transfer are degrees offered at a community college. Both degrees "do not guarantee completion of all prerequisite courses for an

intended major but will allow a student to complete their general education courses and be in junior standing" [14]. To summarize, a collaboration between universities and community colleges ensures a smoother transition for students.

Moreover, transitioning to a campus that is twice as big as a community college can be a shock to students. The number of students to faculty and staff ratio is doubled than what students once were accustomed to and can have a harder time interacting with faculty and staff. In addition, small class sizes in community college compared to large university class sizes, affects students' sense of preparedness, and creates a feeling of isolation [18]. Hence, transfer students experience transfer process-related factors that can affect their academic success.

By breaking down each factor and going into depth gives us a better understanding of what each factor means and how they can prevent a student from accomplishing their academic goals and expectations. Overall, the purpose of this study is to distinguish what factors are affecting transfer students from achieving academic success. Determining these factors allows us to present our findings to the university so that resources and programs are implemented to increase transfer student success.

Methodology

Transfer students face challenges that interfere with achieving their academic goals and expectations. To identify these challenges, the researchers composed a series of questions that fall into factors, that include sociocultural-, academic-, and environmental-factors. To formulate each question, extensive literature review was completed to go into depth of what each of these factors contrive of and how to ask questions regarding these factors. The research methodology is illustrated in Figure 1.
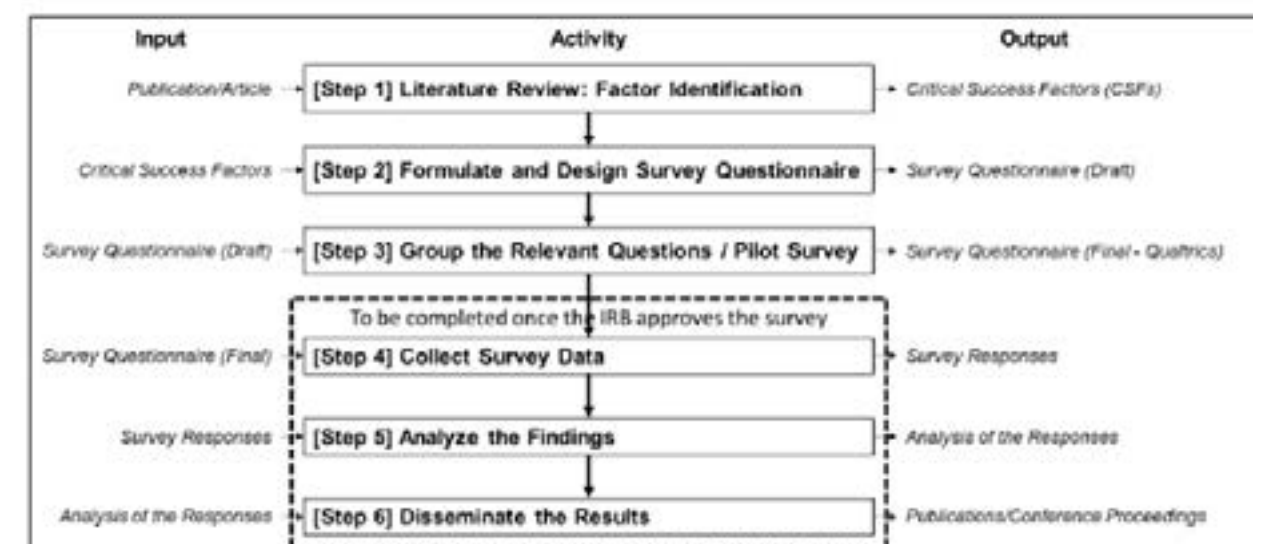

Figure 1. Research Methodology

The first survey draft was evaluated by the research team until the researchers were satisfied that each question was aimed towards responses relating to the critical success factors. To collect each student's response, the researchers used Qualtrics to design the survey and gather data. Each section from our survey is described in detail below. Before collecting data based on factors general questions were asked to learn about the students transfer status. The questions asked was a combination of fill in the blank and multiple choice.

Equity Factors

Learning about a student's background gives us an idea of who they are and what they encounter as students. As shown above in Table 1, the researchers reviewed their sources and formulated a chart that describes each factor in depth. In the equity factor section, the researchers narrowed down the description of what is considered an equity factor based on their literary review and listed the most distinguished equity factors described.

The development of the questions was carefully gathered to ensure that the equity questions being asked was appropriate and clear. The researchers based their format on the type of response that was needed to properly interpret the data. Such as determining the students ethnic background, age group, and what students best describe themselves in terms of their equity status. The questions asked was a combination of multiple response and multiple choice. As such, these specific questions were asked to recognize our transfer student demographic.

Sociocultural Factors

Understanding what obligations students have besides school, allows us to comprehend a students' time management and balance they have in life. As shown in Table 1 above, in the sociocultural factor section there was information gathered from the literary review described what is considered a sociocultural factor. Additionally, the researchers narrowed down what information was essential for the study in terms of what information can affect student success.

For the purpose of this study, the researchers focused on what commitments students must focus on besides school to understand how this can affect the amount of time they have to complete their academic studies. The question asked was a multiple response question that allowed students to choose more than one response.

Economic Factors

Being able to afford school and whether the campus offers the proper financial aid resources to help a student is crucial in understanding the barriers that a student experience. The described information regarding what is considered an economic factor can be identified from the literary review and in Table 1 above. To understand how economic-related factors affect transfer student success, the researchers approached the process of producing the questions by examining what the prominent economic factors are viewed in

the literary review and how can the data be interpreted into the study.

The researchers formulated questions that would receive data on their employment status, the number of hours that students worked, financial aid resources that have been received, and how has the university helped them financially. The questions asked was a combination of multiple choice, yes/no statements, and agree, disagree scale statement questions. These questions allow us to determine what support a student needs in terms of resources and financial aid.

Environmental (Institutional-Oriented) Factors

Recognizing how a university setting can impact a students' academic success is important in determining what support a transfer student needs from a university. The described environmental (institutional-oriented) factors that was gathered from the literary review is detailed and complex. To decide on what the focus was going to be for this study, the researchers narrowed down what are the questions that can be asked, and students would easily be able to answer without making it complicated.

Furthermore, the researchers decided to formulate statements to get a forward opinion of the student's experience. These statements consisted of a student's opinion on campus resources, involvement, sense of belonging, etc. The questions asked was in the format of agree/disagree scale statement questions, yes/no statements, and rating a student's level of concern (i.e., academic performance, advising, childcare, financial resources, housing, networking, sense of belonging, credit transfer) prior to transferring. The statements are formatted to identify what has affected a student from achieving academic success.

Environmental (Faculty/Staff Oriented) Factors

Communication and support are vital when transitioning to a new university. Faculty and staff provide that support and information to assist in transfer students achieving their academic goals and expectations. To determine how have interactions with staff and/or faculty members affects transfer student success, the researchers went over the literary review and description from Table 1 to formulate questions in a concise manner.

These questions were produced on what will give the most efficient data. Thus, the focus of the questions was on how often met up with a faculty member, academic advisor, and if they are provided the resources needed to be a successful transfer student. A series of questions was asked in multiple choice and agree, disagree scale statement format. The reason for this, is to gather how faculty and staff contribute to a student's transfer success.

Transfer Process-Related Factors

Transfer students go through a process from their community college to their transfer university to ensure a transfer pathway is in place. To examine how has the transfer process affected transfer student success, the researchers examined what content can be used for the purpose of the study. Given that the information gathered from the literary review

was extensive the focus was narrowed down based on the students experience in their community college and the transfer process.

Thus, the questions were produced by gathering data on how long the student met with their community college advisor, the transfer process, completing course requirements, etc. to analyze how they affected the students if at all. The questions asked was multiple choice and agree, disagree scale statements. These questions permit us to recognize how the transition from community college to university has influenced their academic experience.

Results

Below is an outline of the survey questions being asked to transfer students to gather data for each critical success factor.

To gather data about a student's transfer status the following questions were asked:
1. Which year did you transfer to Cal Poly Pomona?
2. Which degree(s) did you earn before transferring to Cal Poly Pomona?
3. What is your current major?

To gather data about a student's background the following questions were asked regarding equity factors:
1. Please select your ethnicity
2. Please select the age range that best fits you
3. Which transfer equity status best describes you?

The following question were asked regarding sociocultural factors:
1. Please check the boxes below regarding other responsibilities besides school.

The following questions were asked regarding economics factors:
1. Please answer the following statements regarding your employment status. (Yes / No / Do not wish to answer)
2. How many hours a week do you work?
3. Please select if you receive any of the following financial aid resources.
4. Please select how much you agree with the following statements (Agree, Disagree scale)

The following questions were asked regarding environmental (institutional-oriented) factors:
1. Please answer the following statements regarding environmental factors. (Yes / No / Do not wish to answer)
2. Please rank the level of concerns before transferring to CPP.
3. Please select how much you agree with the following statements based on your current attendance at CPP (Agree, Disagree scale)
4. Please select how much you agree with the following statements (Agree, Disagree scale)

The following questions were asked regarding environmental (faculty/staff oriented) factors:
1. How often you meet with a faculty member outside of your class per semester?
2. How often do you meet with an academic advisor at Cal Poly Pomona (after transferring) per semester?
3. Please select how much you agree with the following statements (Agree, Disagree scale)

The following questions were asked regarding transfer process-related factors:
1. Before transferring how often did you meet with your community college advisor/ counselor regarding the transfer process?
2. Please select how much you agree with the following statements (Agree, Disagree scale)

Discussions (Future Analysis)

This survey is important in understanding what factors cause transfer students to not achieve their academic goals and expectations. It allows the researchers to interpret what these factors are and view what measures a university must take to improve transfer student success. The researchers expected the analysis from this survey will help identify the factors that challenge transfer students' outcomes. Unequivocally, the results will allow for universities to provide the appropriate resources and offer new programs to ensure transfer student success.

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Zhang   **Text Mining for Online Consumer Reviews**
Sonya

Abstract

Online Consumer Reviews (OCRs) such as Yelp reviews have become important to both consumers and businesses. However, the large volume of reviews made it challenging to find meaningful and actionable insights. One way to tackle this is by extracting the topics that matter most to consumers and summarizing the sentiment of these topics. This provides businesses with insights on areas they excel as well as the areas to improve. In a prior study, we used Latent Dirichlet Allocation (LDA) for topic extraction, and Textblob (a Python library) for sentiment analysis on 10,000 Yelp restaurant reviews. In this project, we aim to improve the topic extraction and sentiment analysis performance. We reviewed 22 recent text mining studies on OCRs, with a focus on their modeling techniques. For topic extraction, we found that LDA enhanced with word embeddings techniques such as KGE-LDA (Yao, 2017), lda2vec (Li, 2018; Moody, 2016), and Convolutional Neural Networks (CNN) with GloVe (Zhong and Li, 2019) performed better than the traditional LDA. For sentiment analysis, we found that CNN with GloVe (Salinca, 2017), Naive Bayes (Xu, 2014), Logistic Regression and SVM (Liu, 2020) were more successful than others. In addition, spaCy seemed to be a more promising Natural Language Processing (NLP) library than Natural Language ToolKit (NLTK) for preprocessing (Omran and Treude, 2017). We then experimented with these new machine learning approaches on the Yelp dataset, reported and discussed the results.

Introduction

The use of online review platforms has become an important tool to both the consumer and businesses across industries. Consumers often want to know about the products and services they are spending their money on. This has led to reviews having a large impact on several aspects of a business such as sales (Qiang Ye. et. al, 2009). Businesses may also benefit from consumer feedback to see how their business is operating and if anything could be improved. Making changes can improve how a business is perceived by consumers and therefore increase revenue as well (Woo Gon Kim et al. 2016). Although the importance of reviews is well established, there is still a problem that should be tackled. The number of reviews is ever-growing, and reading through hundreds, sometimes thousands of reviews and extracting insights from them can be overwhelming for both the consumer and businesses. Text mining can help to automate the process of analyzing large quantities of reviews and to quickly discover patterns and insights. In this study, We reviewed 20 recent text mining studies on OCRs, with a focus on their modeling techniques. We then applied three text mining methods involving 5 models for OCRs. The first includes extracting the topics that consumers care most about using an unsupervised learning method called Latent Dirichlet Allocation + Word2vec (lda2vec). The second method involves using a supervised learning model such as Convolutional Neural Networks (CNN) to classify reviews into topics. We use two different renditions of CNN in order to see if word embeddings affected model performance. The first is only CNN, while the second is CNN and Glove. In the third method perform sentiment analysis using Support Vector

Machines (SVM) and CNN. When analyzing both the category of a review along with it's sentiment we can quickly derive information about a business such as a restaurant. For our study we focused on online restaurant reviews provided by Yelp. We experimented with multiple machine learning models to see which ones provide the best performance.

Literature Review

When looking at a survey conducted by eMarketer, 79% of internet users have had their purchases influenced by reviews (E-Marketer, 2013). Numerical ratings can only tell us so much about a business. This makes the common topics and the emotions expressed in these reviews imperative to business improvement. A study conducted on emotions in user reviews found that negative, level-headed reviews tend to influence consumer's decisions more than positive ones due to the perceived honesty (Minwoo Lee et al. 2016). [DRL1] A similar study also found that positive reviews can boost bookings, and therefore increase revenue (Qiang Ye et al. 2009). When looking at the quantity of reviews, they may also have a positive impact on many aspects such as sales (Woo Gon Kim et al. 2016). Such findings indicate that online reviews have become an important part of consumer spending behavior.

The challenge of online consumer reviews (OCR) is that analyzing textual data can be time consuming as is shown by the dataset released by Yelp, which contains over 8 million reviews. Various machine learning models had been created to combat this problem. One popular method is Latent Dirichlet Allocation (LDA) , which has successfully been used to extract the topics most important to consumers (James Huang et al. 2014). LDA for topic modeling has shown high performance levels, and there have been a number of ways to successfully extend it. Through the combination of LDA and various word embedding algorithms, the opportunity to integrate context into Topic modeling has improved the quality of the topics extracted (Sanqiang Zhao et al. 2017; Liang Yao et al. 2017; Ding Peng and Dai Guilan 2016; Christopher Moody 2016). Other extensions of LDA have gone beyond accuracy improvement and have also increased computational efficiency (Muzafar Bhat et al. 2019). In addition to extending LDA through word embeddings, topic extraction can also aid word vector representation in deep learning models (Qin Li et al. 2018).

As well as supervised Convolutional Neural Networks (CNN) model that classifies text and derives meaningful insights at high performance levels (Junmei Zhong and Willian Li 2019). CNN is also very successful when used for image classification which exemplifies its versatility (Rahul et al. 2018).

Consumer sentiment is also an important aspect of understanding the state of businesses through reviews. In addition to text classification tasks, CNN has also been useful for the sentiment analysis of reviews (Andreea Salinca 2017; Ranti D, Sharma et al. 2016). Other sentiment analysis classifiers such as Support Vector Machine (SVM) and Naive Bayes have also shown promising results (Yun Xu et al. 2014; Hemalatha S. Ramathmika 2019; Siqi Liu 2020; Shaoqiong Zhao 2019).

It is important to note that model performance also depends on many factors (Siqi Liu 2020). Factors such as word count, dataset type, and corpus size can affect the performance of models like SVM and CNN (Shaoqiong Zhao 2019; Andreea Salinca 2017; Xiao Yang et al. 2018). In one study, tweets were classified using a deep learning approach and they found CNN outperformed the combination of SVM + TFIDF when looking at the F1 score. However, in another study that used hotel reviews, SVM showed high accuracy as well. (Xiao Yang et al. 2018; Shaoqiong Zhao 2019).

Tool combination may also play a part in model performance as using SpaCy or NLTK for data processing, Condor for sentiment analysis, and SVM for text classification showed high accuracy (La Bella Agostino et al. 2018). Furthermore, it is also shown that choosing the appropriate text preprocessing tool can also aid in yielding higher results. It is shown that Natural Language Processing efficacy depends on the task and data at hand (Foud Nasser A Al Omran and Christoph Treude 2017).

In this study, we will be experimenting a selection of the a forementioned machine learning techniques with a goal of finding the best models most appropriate for our data and tasks (topic extraction, text classification, and sentiment analysis).

Table 1 : Literature Review Methodology

Text Classification

Paper and Citation	Data [leave empty column]	Model	Model Performance And Results	Findings
Predicting Customer Call Intent by Analyzing Phone Call Transcripts Based on CNN for Multi-class Classification Junmei Zhong and William Li (2019)	2200 samples of transcript	Text Classification Global Vectors (GloVe): Word embedding Convolutional Neural Networks (CNN): Text Classification	CNN + GloVe: •F1-Score: 93% •Precision: 93% •Recall: 93% •Accuracy: 92.7%	When paired with GloVe,Convolutional Neural Networks show good prediction performance when classifying long textual data.
Using Word Embeddings in Twitter Election Classification Xiao Yang et al. (2018)	Philippines dataset in English: 4,163 tweets	Text Classification (Corpora impact on classification performance) Convolutional Neural Networks (CNN): Text Classification Support-vector Machine: Text Classification (Baseline)	Philippines Data: SVM + WE (window size of 5,10): •F1-Score: 77.8 •Precision: 79 •Recall: 76.6 CNN (Window of 10, dimension of 800) : •F1-Score: 80.8 •Precision: 82.2 •Recall: 79.4	Havings optimal word embedding settings and having the appropriate corpus improves CNN performance. In this case, CNN performance surpasses baseline models such as SVM with TFIDF.
Cancer Hallmark Text Classification Using Convolutional Neural Networks Simon Baker et. al (2016)	1852 Biomedical publication abstracts.	SVM + BoW CNN + Base	SVM + BoW •F1-Score: 93.1 CNN + Base •F1-Score: 97.1	CNN and SVM show promising results when identifying hallmarks of cancer included in abstracts.
Assessing Perceived Organizational Leadership	46,657 tweets	Text Classification (Supervised)	SVM:	The SVM model provided a quick and automated method of perceiving the sentiment of

			•Accuracy: 84.99	
Styles Through Twitter Text Mining

La Bella Agostino et al. (2018) | | Natural Language Toolkit (NLTK): Data Processing

Snowball: Stemming

Condor: Sentiment Analysis

Support Vector Machine (SVM): Text Classification

SciKitLearn: user | •F1-Score: 71.4%

•Accuracy: 84.1% | tweets in order to classify them into a leadership profile. |

Sentiment Analysis

Paper and Citation	Data	Model	Model Performance and Results	Findings
Thumbs Up or Down? A Text Mining Approach of Understanding Consumers Through Reviews

Shaoqiong Zhao (2019) | 2,004 reviews - 3 star Bally Hotel

2,858 reviews - 4 star Treasure Island Hotel

2,025 reviews - 5 star Venetian Hotel | Sentiment Analysis

Support Vector Machine (SVM) | SVM:

•Accuracy: 94.2% (Highest) for binary classification of Venetian Hotel with 350 features | SVM is good at classifying recommendation decisions. Using more words may not increase performance. |
| Convolutional Neural Networks for Sentiment Classification on Business Reviews

Andreea Salinca (2017) | 8200 - training samples

2000 - validation samples

900 - testing samples. | Sentiment Classification

CNN | CNN:

•Accuracy: 94.6% (Word2Vec self dictionary with CNN and 100D) for the test results. | Large datasets seem to yield better performance. CNN sentiment classification reaches an accuracy of 95.6% |
| Comparison of Machine Learning for Sentiment Analysis in Detecting Anxiety Based on Social Media Data | 4862 Social Media Comments | SVM | SVM + Count Vectorization

•Precision: 63.95

•Recall: 79.71

•Accuracy: 81.50

Random Forest + Count Vectorization

•Precision: 79.06

•Recall: 78.61 | Random forest showed the highest accuracy among all models, SVM came close with an accuracy of 81.50 |

| Sentiment Analysis of Yelp's Ratings Based on Text Reviews

Yun Xu et al. (2014) | 100,000 reviews | Sentiment Analysis/Prediction

Bing Liu opinion Lexicon for feature selection

NLTK for

Preprocessing
Naive Bayes
Perceptron

K Nearest Neighbor

Multiclass SVMs | Binarized Naive Bayes:

•Precision: 98.9% (Highest for rating 4 prediction for Binarized naive bayes)

•Recall: 98.5% (Highest for rating 1 prediction for binarized naive bayes) | Binarized Naive Bayes + feature selection + stop words + stemming outperforms the other models. |
| Sentiment Analysis of Yelp Reviews: A Comparison of Techniques and Models

Siqi Liu (2020) | 271,915 data points for training

90,639 data points for testing. | Sentiment Analysis

Multinomial Naive Bayes

Logistic Regression

Support Vector Machine

Gradient Boosting (XGBoost)

LSTM

BERT | Precision - 70%

Recall - 58.33%

F1-score - 63% | Binary BoW + Bi-grams + text normalization show good performance. Logistic Regression and SVM showed the best model performance (sentiment prediction) |
| Tourism Review Sentiment Classification Using a Bidirectional Recurrent Neural Network with an Attention Mechanism and Topic-Enriched Word Vectors

Qin Li et al. (2018) | 25,000 training and testing samples | neural network

BiGRULA - sentiment analysis

lda2vec - topic modeling | BiGRULA: 91.4 | BiGRULA can achieve better performance than other popular neural network models such as CNN, LSTM, and CNN+LSTM. |

Topic Modeling

Paper and Citation	Data	Model	Model Performance and Results	Findings
Contextual-LDA: A Context Coherent Latent	265,351 terms	Topic Modeling	All reports are categorized into five labeled classes including	Contextual-LDA seems to derive better topics/ results

Paper and Citation	Data	Model	Model Performance and Results	Findings
Topic Model for Mining Large Corpora Ding Peng and Dai Guilan (2016)		Contextual LDA (Supervised LDA)	business, entertainment, politics, sports and technology. Supervised Contextual LDA showed above a 98% Macro-F1 when producing 100 topics.	due to the additional contextual information provided by looking at local and global context. Additionally, a supervised version of LDA also shows improvement over standard LDA.
Mining Coherent Topics in Documents using Word Embeddings and Large-scale Text Data Liang Yao et al. (2017)	50 types of electronic products or domains - 1,000 reviews 50 types of non-electronic products or domains - 1,000 reviews WE-LDA7- 50 domains in each dataset - 50,000	Topic Modeling LDA + Skip-Gram (Word embedding) (WE-LDA)	Highest Precision for Music topic: 85%	WE-LDA improves the quality extracted topics (Compared to LDA due to the consideration of semantics through word embeddings.
Deep LDA: A New Way to Topic Model Muzafar Bhat et al. (2019)	Reuters-21758 Dataset: 9,160 documents (article length)	Improve LDA accuracy/computational time using Deep Neural Networks NLTK WordNet stemmer 2NN DeepLDA (Keras) 3NN DeepLDA (Keras) Gensim LDA Support Vector Classifier (SVC)	Accuracy: •LDA: >0.810 at 30 topics •2NN: > 0.810 at 30 topics •3NN: >0.800 at 30-35 topics	2NN DeepLDA and 3NN DeepLDA combine LDA and Deep neural networks. They show improved accuracy and completes computations quickly in comparison to LDA
Mixing Dirichlet Topic Models and Word Embeddings to Make lda2vec Christopher Moody (2016)	Twenty Newsgroups dataset: 11,313 articles.	lda2vec	Topic coherence of 71.2	The topics in the Twenty News-groups corpus had a high mean topic coherence which were similar to human evaluations of topics. When lda2vec was applied to a Hacker News comments corpus, it found topics within this community and learned linear relationships between

words which allow it to solve word analogies in the specialized vocabulary of this corpus.

Misc.

Paper and Citation	Data	Model	Model Performance and Results	Findings
Choosing an NLP Library for Analyzing Software Documentation: A Systematic Literature Review and a Series of Experiments FouadNasser A Al Omran and Christoph Treude (2017)	Stack Overflow: 200 java related question paragraphs and 200 java related answer paragraphs	NLP Library assessment. Google's SyntaxNext Stanford CoreNLP Suite NLTK SpaCy	The best NLP library depends on the task but spaCy was the most accurate.	In general, SpaCy showed 90% of tokens tagged correctly using Stack Overflow data.
Predicting Online Doctor Ratings from User Reviews Using Convolutional Neural Networks Ranti D. Sharma et al. (2016)	Binary Text Classification/sentiment analysis	Convolutional Neural Networks (CNN)	CNN: •Accuracy: 93% (for binary classification of pos/neg)	CNN shows great performance in binary classification problems.
Learning Semantic Representation from Restaurant Reviews: A Study of Yelp Dataset Sanqiang Zhao et al. (2017)	Item Representation	Word embeddings based on Word2Vec	A word embeddings based approach can lead to better item representation for each restaurant. This is due to additional semantic and contextual information.When looking at the RMSE of this model, LDA and BoW show better Performance. This approach includes semantic context which can improve recommendation scenarios.	RMSE: •Proposed Model: for k=7, 1.472

Convolutional Neural Network (CNN) for Image Detection and Recognition Rahul Chauhan et al. (2018)	MNIST Dataset: 70,000 images.	CNN Deep neural networks with hidden layers	Accuracy on MNIST is 99.6% and on CIFAR-10 is 80.17%. The training accuracy on CIFAR-10 is 76.57 percent after 50 epochs.	The accuracy of MNIST is good. However, the accuracy of CIFAR-10 can be improved by training with larger epochs and on a GPU unit. In addition, the accuracy on training set can be improved further by adding more hidden layers.

Review Insights

Paper and Citation	Data	Model	Model Performance and Results	Findings
The Impact of Online User Reviews on Hotel Room Sales Qiang Ye et al. (2009)	Reviews: 3,625	k-medoids clustering algorithm k-groups	For the Red Roof Inn, method C exhibited scores of 2.8 in k = 5 and 2.75 in k = 10. For the Gansevoort Meatpacking hotel, method C exhibited scores of 2.5 in k = 5 and 2.75 k = 10..	The usefulness score of the sentences generated by method C was higher than methods A and B scores. Model C did better than the other two models.
Improving Restaurants by Extracting Subtopics from Yelp Reviews James Huang et al. (2014)	Yelp Dataset Challenge: 158,00 Reviews	Topic Modeling LDA	The top topics derived from Yelps restaurant reviews (What consumers care most about): 1.) Service 2.) Value 3.) Take out 4.) Decor 5.) Heathiness 6.) Wait 7.) Music 8.) Breakfast 9.) Dinner 10.) Lunch	LDA can be used to show topics that consumers care most about via reviews. When analyzing sentiment based on the time of day, peak hour related reviews showed lower ratings (probably due to a decline in service quality due to the rush) A halo effect was discovered, great food usually included great service, and vice versa.
Roles of Negative Emotions in Customers Perceived Helpfulness of hotel Reviews on a user-Generated review Website Minwoo Lee et al. (2016)	520,668 hotel Reviews	SentiWordNet 3.0 Negative Binomial Regression	H1 and H2 tests were statistically significant	Negative reviews are more helpful than positive ones When negative emotions expressed in reviews were intense, they were seen as less helpful
The Impact of Social Media Reviews on Restaurant Performance: The	Data on variables such as: Review amount, overall guest	Cross-sectional study	Multiple Regression results provided.	• The quantity of reviews is correlated with positive

moderating role of excellence certificate

Woo Gon Kim et al. (2016)

rating from Trip Advisor, Yelp, and restaurant chains.

influence on aspects such as sales.

Methodology

3.1 Data and Text Pre-processing

Our data is provided by the Yelp dataset challenge from round 13. The dataset was initially cleaned to contain 95,291 sentences.

For lda2vec we ran the model using the 95,291 sentences as our documents. For the preprocessing we removed punctuation and words less than 4 characters and more than 25 characters. We then converted all the text to lowercase, used Spacey and NLTK for filtering out stopwords as they showed the best performance for pre-processing (Fouad Nadder A Al Omran and Christoph Treude, 2017). We performed lemmatization and removed missing data. We lost nearly 98% of our data due to the short length of our sentences. After preprocessing, we were left with 1,777 sentences.

When using CNN and CNN + GloVe for text classification, our dataset initially consisted of 9,758 human labeled sentences pulled from the original dataset. Each sentence was labeled with one of five topics: price, location, food, time, and service. The Price label contained 488 sentences, Location: 1,054, Food: 5,223, Time: 333, and Service: 2660. The data was very unbalanced so we decided to undersample using the minority class which was Time at 333 sentences. This left us with a total of 1,665 sentences after balancing. The preprocessing includes converting the sentences to lowercase, removing stop-words, white space and other punctuation. After preprocessing we were left with 1,535 sentences. For CNN + GloVe we were also left with 1,665 sentences after balancing. pre-processed the data in a similar manner as the first, except we also performed lemmatization. After pre-processing, only 1,535 sentences remained. When using CNN and SVM for text classification the dataset contained 9,762 human labeled sentences. We have three labels: positive, neutral, and negative. Positive contained 5,590 sentences, neutral: 1,297, and negative: 2,875. This dataset was also unbalanced so we leveled the data according to the label that contained the least amount of sentences which is the neutral label. The dataset was left with a total of 3,891 sentences. For the preprocessing in CNN we converted the sentences to lowercase, removing stop-words, white space and other punctuation. After preprocessing, 3,810 sentences remained. The SVM dataset was balanced to contain 3,891 sentences with 1,297 for each label. A similar preprocessing process with the addition of

tokenization, stemming, and lemmatization performed by NLTK. After preprocessing 5,825, sentences remained.

Table 2: Data Preprocessing

	Document Type	Before balance	After balance	Before Pre-processing	After Pre-processing
lda2vec	Sentence			95,291	1,777
CNN - Text Classification	Sentence	9,758	1,665	1,665	1,535
CNN + Glove - Text Classification	Sentence	9,758	1,665	1,665	1620
CNN - Sentiment Analysis	Sentence	9,762	3,891	3,891	3810
SVM - Sentiment Analysis	Sentence	9,762	3,891	3,891	2,895

3.2 Topic Modeling

3.2.1 Latent Dirichlet Allocation + Word2Vec (lda2vec)

For topic modeling we decided to use a hybrid model which is a combination of both Latent Dirichlet Allocation (LDA) and Word2Vec. LDA is an unsupervised machine learning model that extracts topics and clumps documents into them. When combined with a word embedding technique, Word2vec, it is able to derive the semantic relationship between the words and documents through a map of word vectors. It does this by taking both the global and local context of the corpus into consideration (Christopher Moody, 2016). lda2vec showed promising results when compared to regular LDA (Qin Li, 2018). We were curious to see if the topics extracted by lda2vec were more coherent than the topics extracted by LDA in our (the?) previous study. The previous study used review sentences as their document so we also used sentences for our model. For our implementation of the model, we trained a Word2vec model that used the skip-gram method with 50-dim word vectors. This was trained for 70 iterations. We set our topic number at 5 to extract five topics and trained the model for 400 epochs.

3.3 Text Classification

3.3.1 Convolutional Neural Networks (CNN)

CNN is a supervised machine learning model used for many classification tasks. It stands out for its usage in image recognition with an accuracy of up to 99.6% (Rahul Chauhan et al. 2018). In addition to image recognition, it also performs text classification tasks with promising results. CNN works as a deep learning model with multiple layers which includes an input layer, a convolutional and pooling layer as well as an output layer. For our study we performed CNN in two different ways. The first used only CNN while the second included some changes to the layers including a GloVe word embedding layer.

For CNN we used a 70% training and 30% testing split. We defined our vocabulary using the bag of words (BOW) method. The parameter configurations include an embedding layer with a vocabulary size of 100. The convolutional layer consisted of a single dimension with 1 filter, a kernel_size of 3, and a relu activation. A MaxPooling1D layer of pool_size 2, flatten layer, and two dense layers with activations of relu and sigmoid. Our model report is shown below:

```
Model: "sequential_9"
_____
Layer (type)              Output Shape           Param #
=================================================================
embedding_9 (Embedding)     (None, 42, 100)          209000
_____
conv1d_9 (Conv1D)           (None, 40, 1)           301
_____
max_pooling1d_9 (MaxPooling1 (None, 20, 1)          0
_____
flatten_9 (Flatten)         (None, 20)           0
_____
dense_18 (Dense)            (None, 10)           210
_____
dense_19 (Dense)            (None, 1)            11
=================================================================
Total params: 209,522
Trainable params: 209,522
Non-trainable params:
```

3.3.2 Convolutional Neural Networks (CNN) with GloVe

CNN combined with word embedding models like Word2vec and GloVe showed promising results in other studies (Junmei Zhong and William Li, 2019) so we decided to implement CNN with GloVe as well. For the split we used 70% for training and 30% for testing. The data was vectorized using the Keras TextVectorization library. For the GloVe word embedding layer we found vectors for 1,464 words. The convolutional layer consisted of one dimension and 1 filter with a kernel_size of 3. The MaxPooling layer contains a pool size of 2 and immediately after

there is a flattening layer. The Dense layer uses softmax as the activation. This model was trained for 400 epochs and with a batch size of 128. Our model report is shown below:

```
Model: "sequential"
_____
Layer (type)            Output Shape          Param #
=================================================================
embedding (Embedding)    (None, 8, 50)          78550

conv1d (Conv1D)          (None, 8, 10)          1510

max_pooling1d (MaxPooling1D) (None, 4, 10)         0

flatten (Flatten)        (None, 40)             0

dense (Dense)            (None, 5)              205
=================================================================
Total params: 80,265
Trainable params: 80,265
Non-trainable params: 0
```

3.4 Sentiment Analysis

3.4.1 Support Vector Machine (SVM)

SVM has been successfully used in many sentiment analysis tasks (Siqi Liu, 2020). SVM is a supervised machine learning model that takes in labeled data similar to CNN. In our study we are using it for sentiment analysis which is a text classification problem. They are often used for binary classification problems (Shoffan Saifullah et al. 2021) but can also be used in multi-class classification models such as ours. We have three labels: positive, neutral, and negative. Our split consists of 70% for training and 30% for testing. The vectorization technique used was TF-IDF.

3.4.2 Convolutional Neural Networks (CNN)

We decided to implement the same CNN model used for text classification in sentiment analysis too. The split and parameters remained the same. Our model is shown below:

```
                  Model: "sequential_6"
_____
Layer (type)            Output Shape          Param #
=================================================================
embedding_6 (Embedding)  (None, 36, 100)        290300

conv1d_6 (Conv1D)        (None, 34, 1)          301

max_pooling1d_6 (MaxPooling1 (None, 17, 1)        0

flatten_6 (Flatten)      (None, 17)             0
```

```
_____
dense_12 (Dense)         (None, 10)             180
_____
dense_13 (Dense)         (None, 1)              11
=================================================================
Total params: 290,792
Trainable params: 290,792
Non-trainable params: 0
```

Results and Discussions

4.1 Latent Dirichlet Allocation + Word2Vec (lda2vec) for Topic Extraction

The top 50 most frequent words from each topic from lda2vec results are shown below:

topic 1: puppy hush message token restriction strongly naan cube cherry dense hack dietary tone carb outlet shred rack doughy jelly slide satisfaction text rank ouse cheesesteak fellow pissed mixture program wake language tail concoction cross gesture indian basement powder newspaper snap character cranberry operation fake voucher slimy flake crumb shirt hurt

topic 2 : message restriction strongly pumpkin dense dietary hack guac tree rack puppy cube jelly language practice shred cross text outlet hush basement tone ouse character cherry concoction facility cheesesteak satisfaction slide shirt powder newspaper indian wonderfully program norm carb trick mixture fellow gesture doughy wake rank sexy hurt ndonesian lately creme

topic 3 : message strongly restriction hack slide dietary runny program carb puppy language text cross tone shred outlet cube guac dense cherry rack shirt hush jelly ouse doughy award snap yolk basement voucher win security fellow character satisfaction tail mural concoction mixture rank baseball cranberry wake grandma powder clientele asparagus newspaper reward

topic 4 : message program cube strongly token slide shirt basement shred language rack tone fellow hack cross dense powder text tail cherry wake pissed outlet mixture security restriction newspaper ouse concoction satisfaction cough image voice reward flake stall jelly sexy fake dangerous mural character creme sourdough puppy content way minimal doughy armesan

topic 5 : lately message cough dense mixture program pot image strongly cube sourdough humus obsess tone cross rish shred rotate sauteed slide text newspaper carb ouse tail basement skimpy

cheesesteak shirt concoction puppy hack restriction security language fellow rack wake trio presence jelly stall terribly hush character celebration rise reward lemongrass outlet

The results were not as coherent as we expected.The main topics we were looking for included: food, price, location, time and service. All of the topics seem to contain a mixture of food. Topics 2, 3, 4, and 5 contain some keywords related to service but not many. The other topics are seldom visible. We believe the reason for the quality of these topics comes from the amount of data used. Using Sentences means our documents are initially short in length, after preprocessing we lost 98% of our data so this may indicate that document size and quantity affect the quality of lda2vec.

4.2 CNN and SVM Models

The results for CNN, CNN + Glove, and SVM are displayed in the 'Model Test Prediction Results Table' below. Our data was balanced well for the CNN models that performed text classification and sentiment analysis. CNN + Glove showed slightly better scores than just CNN alone. This may indicate that the GloVe word embedding layer may be helpful in strengthening the semantic relationship between words. It also showed decent results across all metrics however, they could still be improved. They both contained high f1 scores in the training results with low f1 scores in the test results which may indicate model overfitting.

SVM had a higher accuracy than CNN for sentiment analysis but it also had a lower F1 score and this may be due to the slightly unbalanced data. All models used small datasets due to balancing and preprocessing, so this may have also affected all model performances.

Model Training Results Table 3

Model	Task	Accuracy	F1-Score	Loss	Precision	Recall
CNN	Test Classification	95.07	94.9	7.55	95	95.5
CNN + GloVe	Test Classification	99.16	99	1.8	99	99
SVM	Sentiment Analysis	78	79		81	78
CNN	Sentiment Analysis	99.8	99.07	1.64	98.58	99.64

Model Test Prediction Results Table 4

Model	Task	Accuracy	F1-Score	Precision	Recall
CNN	Test Classification	51.62	35.38	50.20	27.66
CNN + GloVe	Test Classification	59	59	60	59
SVM	Sentiment Analysis	63	65	68	63
CNN	Sentiment Analysis	62.62	41.51	52.68	35.61

Conclusion

Online reviews have become important to consumer spending behavior in the recent years. In this study we performed text mining to a dataset of online consumer reviews using various machine learning models to extract topics, classify text, and analyze sentiment. Extracting insights with these models can help improve recommender systems, provide information about aspects important to consumers and their sentiment. This aids businesses in seeing where improvement is needed or where they are performing well. Consumers may also benefit from machine interpreted data so that they are not overwhelmed by the sea of reviews and can make better decisions about where they spend their money.

When using lda2vec for topic modeling, we found that the length of review sentences and the size of the dataset may affect model performance. The previous study used 95,291 sentences for LDA and 9,653 sentences for the performance evaluation. They found that LDA had an average accuracy of 47.67% whereas the baseline was 25% for 5 topics (Zhang et al. 2020). The topics extracted by their model were more coherent compared to ours which could mean that having more data when using models like LDA could improve performance.

For text classification, we found that CNN + GloVe shows better performance than CNN alone. There is also a higher F1 score in the training results compared to the test results which indicates model overfitting.

For sentiment analysis, SVM performed better than CNN with a higher F1 score without overfitting.

In the future, we hope to explore the performance of lda2vec with longer documents as well as a larger dataset. This could improve the performance and results compared to other models like Latent Dirichilet allocation (LDA) or lda2vec. We would also like to increase the amount and quality of our labeled data further tune the parameters for CNN+GloVe and SVM to improve their model performances. We may explore other promising models such as K-nearest-neighbors (KNN) and XGBoost (XGB) for both text classification and sentiment analysis.

Author Contributions

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