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Contents

Contents

Contents

Contents

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Effect of winter annuals on animal performance of early weaned calves

Abstract

California farms and ranches generated more than $50 billion in cash receipts with dairy leading the way at $6.56 billion, followed by grapes ($5.79 billion), almonds ($5.60 billion), strawberries ($3.10 billion), and cattle and calves ($2.53 billion). In southern California, weaned calves are often backgrounded in part by feeding costly concentrate-roughage feed supplements. Lack of suitable and reliable forages year-round contributes to this feeding strategy. In this study winter grasses, small grains, mainly barley (Hordeum vulgare L.), will be inter-seeded with winter legume winter vetch (Vicia villosa L.) and a permanent pasture will be established, and grazed directly by early weaned (stocker) calves. The objective will be to research the effect of changing pasture conditions on animal performance. Winter annuals will be established in September 2020 to be ready for grazing in December 2020 through April 2021. The average daily gain will be measured to determine the performance of early weaned calves during the winter annuals. We hypothesize that animal performance of early weaned (stocker) calves grazing winter annuals comprising grass/legume mixtures will not differ with those backgrounded on conventional roughage-concentrate mixtures typically fed to weaned calves in California. This research will provide valuable information that will benefit cattle producers in California, students and the scientific community.

Major objective

Research the effect of changing pasture conditions on animal performance of early weaned calves.

Hypothesis

We hypothesize that the animal performance of early weaned (stocker) calves grazing winter annuals comprising grass/legume mixtures will not differ with those backgrounded on conventional roughage-concentrate mixtures typically fed to weaned calves in California.

Background research with analysis and summary of literature review:
Problem/Issue to be Addressed: California farms and ranches generated more than $50 billion in cash receipts with dairy leading the way at $6.56 billion, followed by grapes ($5.79 billion), almonds ($5.60 billion), strawberries ($3.10 billion), and cattle and calves ($2.53 billion). In southern California, weaned calves are often backgrounded in part by feeding costly concentrate-roughage feed supplements. Lack of suitable and reliable forages year-round contributes to this feeding strategy. Winter grasses and small grains, mainly barley (Hordeum vulgare L.), will be inter-seeded with winter legume winter vetch (Vicia villosa L.), and grazed directly by weaned (stocker) calves. A permanent pasture will also be established. The forages will be selected because of their persistence under winter conditions, and ability to withstand water stress but still perform as per expectations.

Goal: To establish pasture-based systems for stocker calves that would support the calves with the least pressure on the water resources, economy and environment during the backgrounding/growth phase. This system should compare favorably with the costly

conventional feedlot system whereby conserved forages (hay or silage) plus concentrate supplements are normally fed to animals of this class in southern California. This study aims to develop efficient, cost effective and sustainable pasture-based management systems suitable for weanling (stocker) calves.

Importance of Research: This research will provide valuable information that will benefit cattle producers in California, students and the scientific community. Furthermore, this project will lay a solid foundation and increase Cal Poly Pomona capability to forge partnerships with system-wide institutions and also attract additional funding to continue with research in this area.

Methods (Experimental procedure/design):
Experiments will be conducted on beef cattle pastures on Cal Poly Pomona campus, Pomona, CA. Soils in the experimental area are in the Biscailuz-Pico complex: very deep, somewhat poorly drained soils, with a fine-loamy texture. The topography is level to gently sloping 0 to 2%.

Pastures
Winter annuals, barley (Hordeum vulgare L.) mixed Vetch (Vicia villosa L.) and a permanent pasture will be established in September 2020 to be ready for grazing in December 2020 through April 2021. Forage seeds will be established using minimum tillage techniques. To minimize competition between existing and new forages at establishment, permanent forages on experimental pastures will be mowed down to approximately 3 cm before sod-seeding with winter annuals.

Animals
Experimental animals will be managed following the approved guidelines and recommendations of the Institutional Animal Care and Use Committee. Fall-born calves to be weaned in February will be used in this experiment. Twenty-seven weanling (stocker) calves will be assigned randomly to three treatments, replicated three times. Experimental animals will be sourced from Cal Poly Pomona cow herd or sale auction. An experimental unit will comprise of three calves in a plot. Animals will be weighed and sampled on day 1 and every four weeks thereafter until removed from the experiment. Animals will be dewormed and vaccinated (if necessary) before being placed on experimental plots. Where needed, the calves will be provided shade and shelter (from increment weather) using moveable carports. Trace mineralized salt block and water will be provided free choice throughout the experimental period.

Treatments
The treatments are as follows:
Winter period:
    1) Feedlot System (Control Group)
    2) Permanent Pasture
    3) Barley and Vetch

Procedures

During the winter period, forages will be established in September to be ready for grazing in February 2021 through April 2021 (Figure 1a). Seven-month old fall-born calves will be used during this period. After the experiment is over, the calves will be shipped to a feedlot for finishing.

Figure 1a: Winter Annuals Grazing Management Plan
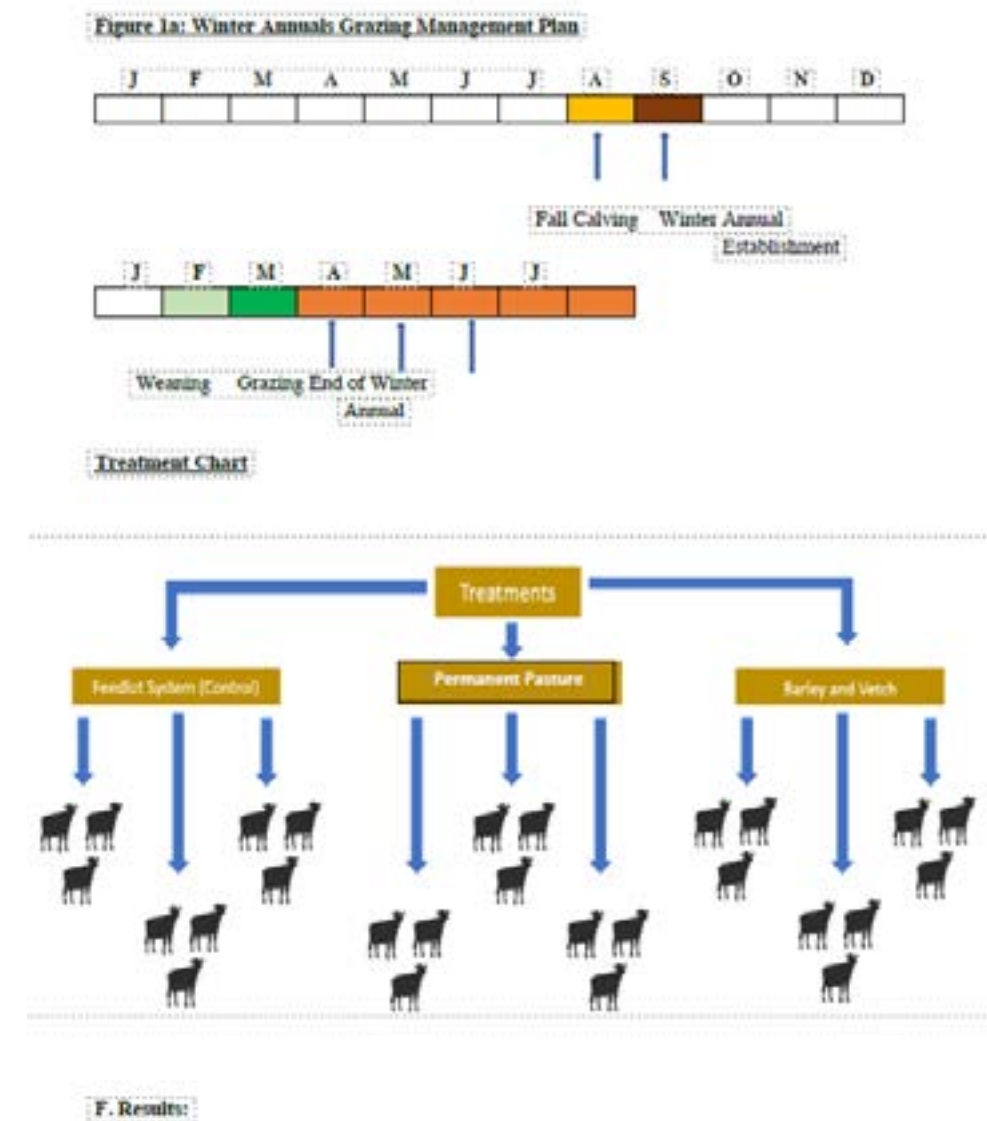
Data Table 1 Performance of calves grazing winter annual forages vs. feedlot feeding

Performance of calves grazing winter annual forages vs. feedlot feeding

Data Table 2 Dry Matter Intake (Feedlot calves)

DM Intake (Feedlot calves)									
Period 1	Period 2		Period 3		Period 4		Period 5		
lb/d	kg/d	lb/d	kg/d	lb/d	kg/d	lb/d	kg/d	lb/d	kg/d
7.5904	3.4501997	8.1580838	3.7082199	9.9775704	4.512532	14.298093	6.4991332	18.620965	8.4640748
6.5112	2.9596499	6.458483	2.9356741	7.9420563	3.6100256	10.292402	4.6783643	12.674269	5.7610315
5.9357	2.6980234	6.373503	2.8970468	7.500831	3.4094686	11.126921	5.0576912	14.025791	6.3753596
4.5327	2.0603088	4.5549301	2.0704228	5.9565423	2.7075192	7.3715849	3.3507204	8.8599751	4.0272614
6.1425	2.7920455	6.38625	2.9028409	7.831	3.5598864	10.77225	4.8964773	13.54525	6.1569318

Data Credit: Josue Figueroa

Notes:
BW= calf bodyweight
ADG1 – average daily gain (Period 1); ADG2 – average dail gain (Period 2); ADG3 – average daily gain (Period 3); ADG4 – average daily gain (Period 4); ADG5 – average daily gain (Period 5)
Values in red – average for the group of calves

Overall average daily gain for each group graph

Average Daily Gain Per Group
2
1.5
1
0.5
0
-0.5
1
2
3
4
5
1.5219
1.3636
1.5157
1.1382
0.9984
0.8929
0.737
0.619
0.517
0.556
-0.3493
0.5235
Feedlot Group
Permanent Pasture Group
Barley and Vetch Group
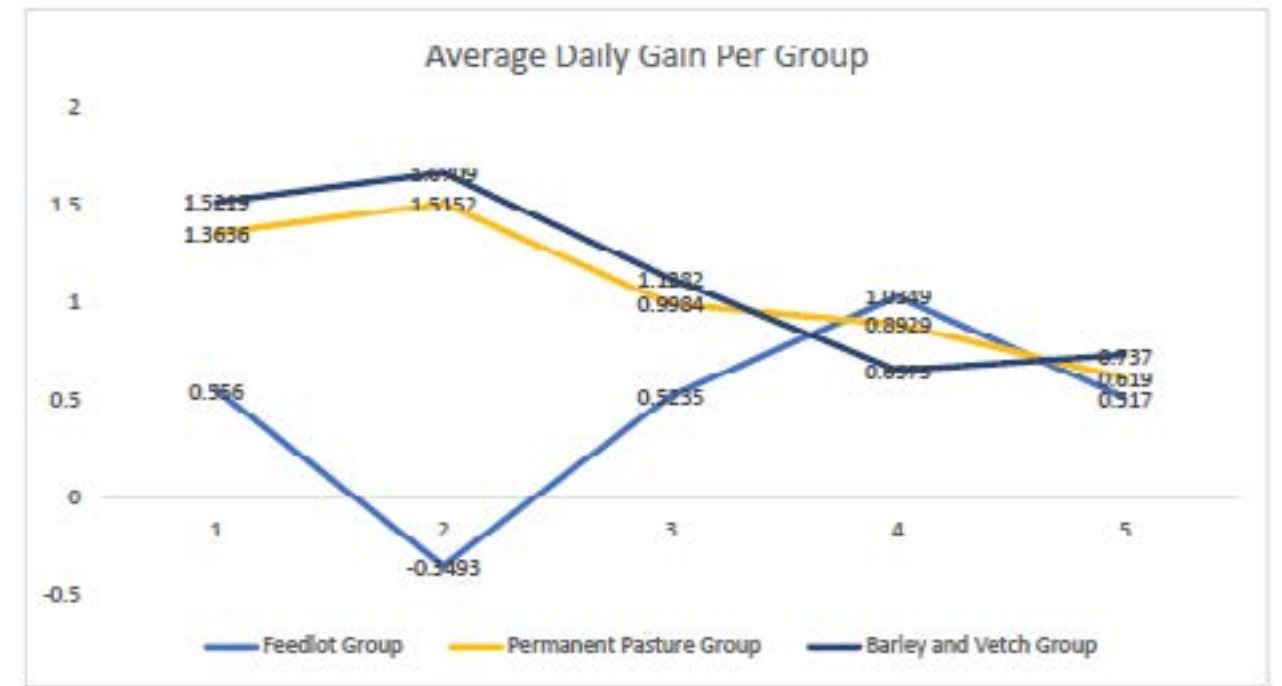
Discussion

Our study was definitely affected by the COVID-19 pandemic. However, thanks to my mentor Dr. Gekara I was able to successfully complete my McNair research project and present it at the McNair Symposium. The results of my research are summarized below.

Using the data provided by my mentor a conclusion was determined regarding the results. As shown in the tables and the overall average daily gain graph the calves grazing winter annuals gained overall more weight for the duration of the study compared to the feedlot group. The graph shows the barley and vetch group on top throughout the study compared to the permanent pasture and feedlot group. There was one small expectation at that is on the average daily gain calculated on 05/25/20 where the feedlot group actually gained more weight on average compared to the other two groups. This can be due to several factors. For example, the feedlot group might have eaten more during the month of May compared to the barley and vetch and the permanent pasture group. However, the data clearly show that the overall performance of early weaned calves grazing winter annuals compares favorably to those being fed the traditional feedlot system. The feedlot group gained an average of 0.3515 kg a day, the permanent pasture group gained on average 0.7987 kg a day, and the barley and vetch group gained 0.8320 kg a day which is almost double more weight on average compared to the feedlot group. Due to the data and results we had to reject our hypothesis which stated that that the animal performance of early weaned (stocker) calves grazing winter annuals comprising grass/legume mixtures will not differ with those backgrounded on conventional roughage-concentrate mixtures typically fed to weaned calves in California. The results clearly show that the performance of early weaned calves grazing winter annuals was better than those in the feedlot group.

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Alaniz   **Mentoring Relationships among First-Generation Latina/x**
Cintia   **College Students**
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Abstract

The U.S. Hispanic population reached 60.6 million in 2018 making them the nation's largest ethnic and racial minority. Additionally, the hispanic undergraduate enrollment more than doubled a 134 percent increase from 1.4 million to 3.2 million students. Despite the changes in demographics, Latina/o/x college students remain at risk of not completing college. First-generation college students, specifically Latina/o/x students are often underrepresented and are faced with many challenges across their academic careers. They often lack basic knowledge about college, including degree expectations and planning, expenses and funding, and career preparation, placing them at risk for non enrollment, poor adjustment, and lack of persistence (Moschetti, Plunkett, Efrat & Yomtov, 2012). Over the past few decades research has found that mentorship is related to several desired outcomes in college students including academic success, connectedness and career development. Students that have a mentor or role model in their lives are less likely to deal with stress and other factors that can influence psychological well-being. Furthermore, students who have a mentor are more likely to feel part of the university and have a higher chance of succeeding. This study investigates how mentoring impacts academic self-efficacy, sense of belonging, psychological well-being, acculturation, and cultural congruence among first-generation Latina/o/x college students.

The Hispanic population of the United States reached 60.6 million in 2018 making them the nation's largest ethnic minority (U.S. Census Bureau, 2018). Hispanic undergraduate enrollment had a 134 percent increase from 1.4 million to 3.2 million students (National Center for Educational Statistics, 2018). With the steady growth of the U.S. population of Latina/o individuals, and decrease in college completion, it is important to identify the specific psychological and cultural mechanisms that influence Latina/o/x students to complete their degree (Bordes & Arredondo, 2005). More specifically Latina college students. It is evident, Latina/o/x are a significant portion of the U.S. population and will continue to be prominent in American Society. Therefore, it is extremely important to focus on how to support and retain Latina/o/x individuals in higher education through mentoring and strong support systems.

Mentors may play an important role in transmitting attitudes to youth by role modeling meaning and purpose in their own lives and conveying a passion for their work and long-term engagements and causes (Liang, Spencer, Brogan & Corral, 2016) Mentoring relationships have been defined as connections between more experienced individuals and less experienced (often younger) mentees in which the former plays a role in guiding the mentee in some area of the mentee's life (Lund, Liang, Konowitz, White & Mousseau, 2019). Mentorship relationships can most commonly develop between individuals that share similar beliefs, values, ethnic/racial or cultural backgrounds; this likeness may enhance a sense of trust, familiarity, and supportiveness (Bordes & Arredondo, 2005).

Furthermore, self-efficacy can be increased by developing mentoring relationships.

Self-efficacy can be defined as one's belief that they can obtain a specific goal. Mentoring and academic involvement are likely to impact self-efficacy (DeFreitas & Bravo, 2012). Mentors are by definition intended to be role models to their mentees and often offer advice and suggestions for success. In addition, when students have a strong source of support they are more likely to achieve their goals (DeFreitas & Bravo, 2012). Although mentoring can come from different sources, studies show that when students have faculty mentors their self-efficacy increases.

Faculty members are likely to encourage students with whom they interact. In turn this interaction will increase student's self efficacy because faculty members are usually perceived as credible and knowledgeable, their encouragement and faith in students' academic abilities will be believed (DeFreitas & Bravo, 2012). However, studies have found that faculty interactions other than mentoring also influence self-efficacy. Faculty-student interactions such as sharing with the students, advising students on research and being accessible had a positive effect on student self-efficacy (Vogt, 2008). Therefore, due to the influence of self-efficacy on academic achievement, it is important for students to be aware of how powerful and crucial such interactions could be.

Types of Mentoring

Studies have identified two forms of mentoring students receive during college. Informal mentoring can be a loosely structured relationship between two individuals where one is guided while formal mentoring is structured and rounded by an objective, it is also described as instrumental support (O'Brien, Biga, Kessler, & Allen, 2010). Furthermore, research shows that mentees in informal/psychosocial mentoring relationships experience greater career support and higher salaries than those informal relationships (O'Brien, Biga, Kessler, & Allen, 2010). Informal mentoring relationships can also be more personal. Both the mentor and mentee can share personal problems and the mentee views the mentor as a trustworthy source of support. As a result, informal mentoring is often more approachable and easy to engage in. Additionally, informal mentoring relationships can often develop into long-term friendships as opposed to formal mentoring relationships that usually end when the objective has been reached or accomplished.

First-generation college students, specifically Latina/o/x students are often underrepresented and are faced with many challenges across their academic careers. They often lack basic knowledge about college, including degree expectations and planning, expenses and funding, and career preparation, placing them at risk for non enrollment, poor adjustment, and lack of persistence (Moschetti, Plunkett, Efrat & Yomtov, 2012). Furthermore, being the first in their families to attend college can often leave students feeling like they are not part of the university which can negatively impact their psychological well-being. Mentoring programs have been found to increase retention in higher education by providing support, reinforcement, and emotional sustenance that aids students in recognizing they are capable of succeeding in college (Nora & Crisp, 2007). Unfortunately, first-generation college students are often not aware of resources offered at their institutions and expose them to a number of challenges when it comes to adapting. One major challenge first-generation college students face is feeling like imposters. Imposter syndrome happens when students doubt their accomplishments and attributes their success to luck (cite).

However, when college students have a strong source of support their connectedness and sense of belonging increases. Students' level of involvement, connectedness, and integration with the university are important determinants of their academic persistence and success (Tinto, 2006). Therefore, when first-generation students are more involved and connected to their department they are more likely to succeed and have strong academic persistence which can determine their academic success. As a result, studying the psychological correlates of mentoring needs further attention. Research suggests that in order to facilitate more postsecondary and occupational success, mentors may inspire Latina/o/x students in making their trajectory through college more intentional (Aguilar & Amen, 2012).

Gender Differences in Mentoring

Literature on mentoring based on gender shows that female mentors are more likely to provide psychosocial support than male mentors (Allen & Eby 2004). This can be attributed to how male and female mentors approach mentoring and how society views gender norms. Women are expected to nurture and men are expected to be more rational and practical. Studies show that male and female protégés experience greater challenges related to career goals and risk orientations from their male mentors as compared to their female mentors (Ensher & Murphy, 2011). Conversely, studies suggest that college students benefit more from having the same gender role models. Women that have a female role model are more positively affected than compared to having a male role model, and they tend to identify more with female role models (Lockwood, 2016).

Researchers have found that Latina/o students' decisions to leave the university are related to their perceptions about barriers. Therefore, having a mentor/strong source of support is crucial when it comes to retaining students in college. Additionally, in a study related to mentoring and role models, twenty-seven percent of women stated that it was important for them to have a role model who had overturned gender stereotypes or achieved success in a traditionally male-dominated field (Lockwood, 2016). Mentoring is a protective factor, guiding students through their college years to successfully graduating. Mentoring has been linked to boosting academic achievement, social development, and chances for long-term success especially among first-generation college students (Moschetti, Plunkett, Efrat & Yomtov, 2012). Several studies have shown how mentoring can positively affect the lives of students in a number of ways. For example, students who have a mentor are more likely to feel part of the university and have a higher chance of succeeding. The purpose of this study is to look at psychological and cultural correlates of mentoring in Latina college students and the following research questions are proposed:

1. What is the relationship between mentoring and psychological distress?
2. What is the relationship between mentoring, social suppwhatort, and academic self-efficacy?

Method

Participants

A sample of 221 adults self-identified Latina/o/x full-time college students attending a public university identified as a Hispanic Serving Institution were recruited for this study using SONA. The ages ranged from 18-47 years old with an average of 22.18. Females

composed 77% (170), male 23% (50), and other .5% (1). When it came to class standing we had First year 18.6% (41), Second year 9.0% (20), Third year 27.6% (61), Fourth year 38.5% (85), Fifth year or above 6.3% (14). Additionally, when it came to mentoring preferences 35.7% (79) prefer informal mentoring (psychosocial), 63.8% (141) prefer formal mentoring (instrumental)

Data Collection

Demographics. Demographic information was collected; which included questions regarding age, gender, ethnic/racial background, class standing, major, grade point average, place of birth, socioeconomic status, generation status, and sexual orientation.

Mentoring. Mentoring Scale (Gloria, 1993), is a six-item scale used to examine the degree to which students feel they have a mentor or role model in the university setting. The first five questions assess whether there is one or more professors, instructors, or counselors who have encouraged the students, taken them under their wing, cared about their educational success, and asked students if they had persons on campus they considered a mentor or role model. The response options were no one, one person, and two or more persons, which were scored 0, 1, or 2, respectively. An additional question asked students to rate on a 5-point Likert-type scale the extent to which this person(s) helped them adjust to campus life. Responses to these six items were summed. Total scores could range from 1 to 15, with higher scores reflecting more mentoring experiences (Gloria, 1993).

Cultural Congruence. Cultural Congruity Scale (CCS). The CCS (Gloria, 1993; Gloria & Robinson Kurpius, 1996) is a 13-item scale based on the Perceived Threat Scale (Ethier & Deaux, 1990). It examines students' perceptions of the fit or congruity between themselves and their values, and the values of the university. Sample items include "I feel that my ethnicity is incompatible with other students"; "My family and school values often conflict"; "I feel accepted at school as an ethnic minority." A 7-point Likert-type response format was used with responses ranging from 1 (not at all) to 7 (a great deal)

Psychological Distress. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a scale used to measure mood or emotion. The scale is composed of 20 items, with 10 items measuring positive affect (e.g., excited, inspired) and 10 items measuring negative affect (e.g., upset, afraid). Each item is rated on a five-point Likert Scale, ranging from 1 = Very Slightly or Not at all to 5 = Extremely, to measure the extent to which the affect has been experienced in a specified time frame.

Academic self-efficacy The self- efficacy for self-regulated learning scale (Bandura, 1989a) has 11 items that measure students' perceived capability to use a variety of self-regulated learning strategies (e.g., arrange a place to study without distractions?). The self-efficacy for academic achievement scale (Bandura, 1989a) is composed of nine items that measure students' perceived capability to achieve in nine domains: mathematics, algebra, science, biology, reading and writing language skills, computer use, foreign language proficiency, social studies, and English grammar (e.g., learn reading and writing language skills?)

Sense of Belonging. Sense of Belonging Scale -Revised (Hoffman, Richmond,

Morrow, & Salomone, 2002-2003) is a scale used to measure sense of belonging among college students. The scale is composed of 4 factors; Perceived Peer Support (8 items), Perceived Classroom Comfort (4 items), Perceived Isolation (4 items), and Perceived Faculty Support (10 items). The scale scale is a 5-item assessment and uses a 1-5 rating system with 1 being Completely Untrue and 5 being Completely True. Sample items include, "I have developed personal relationships with other students in class" and "I rarely talk to other students in my class." Individual factors were created by adding their respective items and calculating their mean. There are no Weights. No questions are reversed scored.

Social Support. The Social Support Scale (Hamby, Grych, & Banyard, 2015) is an 11-item instrument measuring perceived social support from family (e.g., "My family really tries to help me"), friends (e.g., "I can count on my friends when things go wrong"), and adults other than family (e.g., "In my life right now, there are adults other than my parents who would give me good suggestions and advice"). The instrument was adapted from the Multidimensional Measure of Perceived Social Support (Zimet, Dahlem, Zimet, & Farley, 1988). Participants respond to each item on a four-point Likert-type scale that ranges from 1 (not true about me) to 4 (mostly true about me).

Acculturation. The Vancouver Index of Acculturation (VIA; Ryder, Alden, & Paulhus, 2000) is used to measure heritage culture, it may be the culture of one's birth, the culture in which one has been raised, or any culture in one's family background. The scale is composed of 20-items measuring accululation (e.g., "I am interested in having friends from my heritage culture"). Participants respond to each item on a nine-point Likert-type scale that ranges from 1=Disagree to 9 = Agree.

Results

Academic self-efficacy and psychological distress

For the first research question we compared academic self-efficacy and psychological distress. We found a significant negative correlation between academic self-efficacy and psychological distress (general negative affect). In other words, as negative emotions increase academic self-efficacy decreases. Additionally a linear regression model showed that psychological distress is a strong predictor of academic self-efficacy. These findings confirmed our initial hypothesis.

Correlations

		ASE_tot	General Negative Affect Total
ASE_tot	Pearson Correlation	--	
	N	217	
General Negative Affect Total	Pearson Correlation	-.249**	--
	Sig. (2-tailed)	.000	
	N	216	216

**. Correlation is significant at the 0.01 level (2-tailed).

Graph
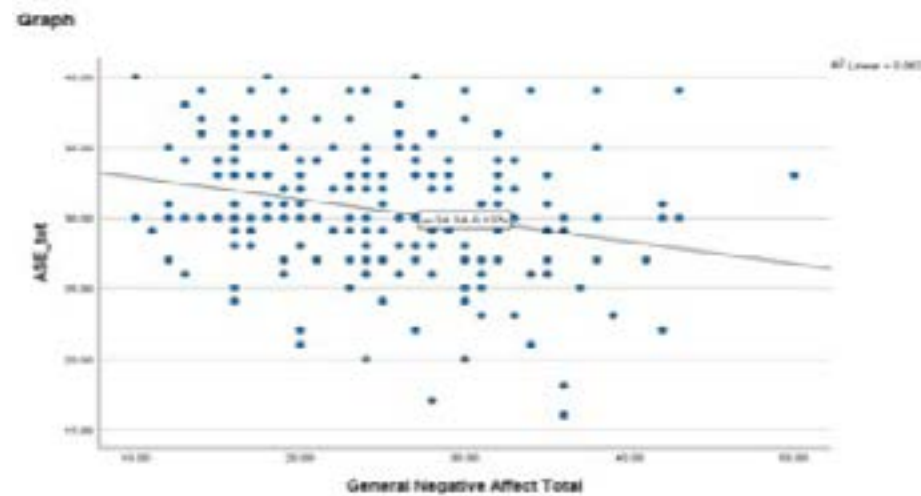
Mentoring and sense of belonging

For the second research question we found a significant positive correlation between mentoring and sense of belonging. As mentoring increases, the sense of belonging also increases. Therefore, we can conclude that mentoring is a strong predictor of sense of belonging among students.

Correlations

		SB_tot	Ment_tot
SB_tot	Pearson Correlation	--	
	N	218	
Ment_tot	Pearson Correlation	.345**	--
	Sig. (2-tailed)	.000	
	N	217	217

**. Correlation is significant at the 0.01 level (2-tailed).

Graph
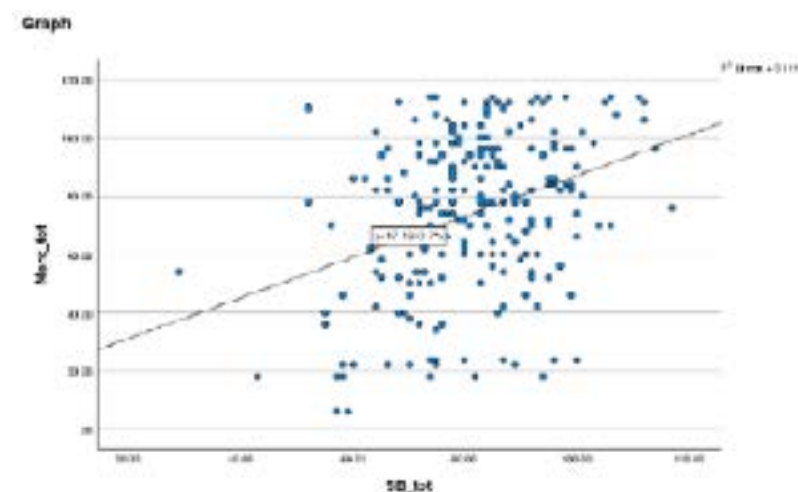
Gender Differences

We compared females and males to see if there were any differences in academic self-efficacy and sense of belonging. Men experience higher academic self-efficacy and have a statistically significant higher sense of belonging. This can be due to several unknown factors that we plan to investigate in future research.

Discussion

The results alianged with previous research in this area, and as expected we discovered that mentorship is related to several desired outcomes in college students and students who have a mentor have a higher chance of succeeding because they experience a higher sense of belonging that in turn increases academic self-efficacy. We found a significant negative correlation between academic self-efficacy and psychological distress (general negative affect). Furthemore, we also found a significant positive correlation between mentoring and sense of belonging.

Implications

Institutions must provide crucial resources that will allow Latina/o/x first-generation students to succeed academically. Some of the resources universities must provide must include mentoring programs, early exposure to career planning, enhance student support services, foster a success-oriented mindset and sense of belonging, and find ways to remove institutional obstacles to success.

Limitations

The majority of the participants were psychology and sociology majors which is a limiting factor in this study. However, in future research we will aim to gather a more diverse pool of participants from other majors and backgrounds.

Conclusion

The psychological distress first-generation Latina/o/x college students experience directly impact their academic self-efficacy. Students with mentorship relationships feel more connected to their institutions. Men experience a higher sense of belonging and higher academic self-efficacy when compared to women.

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Latin American Anti-government Protest: an Analysis of the Contributing Factors

Abstract

In this research project, the question that aims to be answered is: Why are the contemporary Latin American anti-government protests occurring? The time frame that will be analyzed will start from 2005 and will look at Nicaragua's 2018 protests and Chile's 2019 protests in order to try and answer this question. Researchers and scholars have put forth different theories that explain why citizens would protest against the government and theories regarding mobilization. There are four distinct categories in which each of these explanations can be placed in: Social factors, Political/Institutional factors, and finally economic factors. The explanations within the Social factors categories are loosely connected and related to the psychological and social elements of protest explanation. The Political/Institutional, Economic, and Technological elements within their respective categories are all very interconnected with each other and build compounding explanations. These four main categories embody the main literature that seeks to answer why protests against the government occur. The research's findings would support the notions put forth in the explanations that revolve around the existence of opposition groups; opposition groups are a necessary factor for the proliferation of anti-government protests.

Introduction

Anti-government protest refers to when the populace begins to protest against its own government for a myriad of reasons. Although such a definition sounds self-explanatory, there are a large number of reasons and factors that instigate these anti-government protests and lead to such widespread discontent. In the Latin American context, there has been a noted proliferation of anti-government protests around the region; Venezuela, Nicaragua, Brazil, Chile, Mexico, and many others. The purpose of this thesis is to answer the research question, why are contemporary Latin American anti-government protests occurring?

There are a wide variety of explanations and theories regarding the factors that instigate anti-government protests that are debated in the field of comparative politics. For the purposes of this research analysis, the focus on anti-government protests that are being analyzed in Latin America are Nicaragua's 2018 protests and Chile's 2019 protest movements. There are a wide variety of researchers that focus on such a topic, with many focusing specifically on the Latin American region. Theories regarding the factors that instigate protest incidence are vast, however, for the purposes of foundation, the major theories will be subcategorized into four major categories; Social, political, economic, and technological elements. Many of the theories that are outlined in the upcoming literature review will be called upon for an examination regarding the nature and proliferation of anti-government protests in Latin America. Following this section, the research design and methodology section will justify and explain why specifically Nicaragua and Chile's protest movements were selected as well as how the research is to be conducted. After which, the analysis and findings sections will discuss the results that were found regarding explanations and their evidence that was gathered from Nicaragua and Chile's case studies. The analysis section will test different explanatory variables in order to see which case studies support the different theories regarding why anti-government protests occur.

which case studies support the different theories regarding why anti-government protests occur. Due to the extremely contemporary nature of the protests being analyzed and lack of comprehensive databases on other factors, there was a need to in some instances use secondary sources in order to get a detailed and accurate portrayal of the factors that were contributing to the proliferation of anti-government protest. The findings of this study would be able to be applied in many instances of anti-government protest around the region of Latin America.

Research Question

My research question is as follows: why are the contemporary Latin-American anti-government protests occurring? This thesis will analyze the factors and influences that scholars have put forth in explaining the proliferation of anti-government protests in Latin America. In this study, I will analyze economic, social perspective-based, political institution strength, and opposition group explanations that scholars have put forth in order to get to the root of what factors have broad application across Latin America.

This question is extremely pertinent for a variety of reasons. For one, Latin America is currently experiencing a wave of anti-government protests around the region, and understanding these protests will have explanatory power into the condition of Latin American governance. Further, many of these protests will have serious political, economic, and social ramifications on the future of Latin American politics and may in certain cases lead to regime changes or have spillover effects into their neighboring countries. As such, it is extremely important to look into the factors that are influencing the proliferation of anti-government protests.

Argument

As was noted earlier, the research question that this thesis aims to answer is, why are the contemporary Latin American anti-government protests occurring? The main argument that is posed in this thesis is that opposition groups are the critical factor in the proliferation of anti-government protests. To be specific, this thesis analyzed both the Chilean and Nicaraguan case studies and noted that the opposition group explanations were supported in both instances. Without opposition groups, it would be significantly more difficult for anti-government protests to proliferate and mobilize.

Literature Review

In this thesis, the question that aims to be answered: Why are the contemporary Latin American anti-governments protests occurring? Researchers and scholars have put forth different theories that explain why citizens would protest against the government and theories regarding mobilization. There are four distinct categories in which each of these explanations can be placed in: Social factors, Political/Institutional factors, Social media factors, and finally Economic factors. The explanations within the Social factors categories are loosely connected and related to the psychological and social elements of protest explanation. The Political/Institutional, Economic, and Technological elements within their respective categories are all very interconnected with each other and build compounding explanations. These four main categories embody the main literature that seek to answer why protests against the government occur.

I) Social Elements

In this thesis, the question that aims to be answered: Why are the contemporary Latin American anti-governments protests occurring? Researchers and scholars have put forth different theories that explain why citizens would protest against the government and theories regarding mobilization. There are four distinct categories in which each of these explanations can be placed in: Social factors, Political/Institutional factors, Social media factors, and finally Economic factors. The explanations within the Social factors categories are loosely connected and related to the psychological and social elements of protest explanation. The Political/Institutional, Economic, and Technological elements within their respective categories are all very interconnected with each other and build compounding explanations. These four main categories embody the main literature that seek to answer why protests against the government occur.

I) Social Elements

This thesis being a study into the nature of anti-government protests will begin with a look at the social elements that influence the rise of anti-government protest. To begin, one of the big ideas that has circulated within the social context is that of the local community's values and the values of the government will either clash or coincide; should the community's values be in line with the government they would be much more willing to support the government's repression of anti-government protest, (Akkus 2019). This study was put in the perspective of the Gezi Protests in Turkey and the cultural and communal attitudes of the local communities in Turkey; Akkus' findings uphold the idea that willingness to support or go against the government are correlated to the values of the individual and community, often times in the social context of conservatism versus liberalism. Should these implications hold true for Latin America, one could expect protests against the government to be at least partially motivated by a perceived difference in social values that the protestors do not agree with.

Another key component of the Social element category of literature that aims to explain why anti-government protests occur is the role of the imaginary. In the post neo-liberal era of Latin America, studies indicate that the social imaginary of protestors has shifted from a specific position on the political spectrum to rather a targeted grievance against specific failures from political institutions; the language of the imaginary has been converted to one of a non-aligned middle/working class fight in the name of the "Republic" rather than any specific political alignment, (Ferrero 2016). Considering this in the Latin American context, this would indicate that in the social regards, that the modern anti-government protests are being framed from no particular political standpoint but rather reflect a psychological falling out with the government that they aim to make vocal and to restore the integrity of the "Republic". In the broader context of comparative politics, Kim's (2018) study of Korean anti-government protests would compound the idea of protest as a psychological means of expressing emotion regarding the government; it found that in a collective sense it was to communicate the idea that the people are ultimately the ones in control of the government, not the other way around. In an individual sense however, the study found that served as a form of personal satisfaction of venting emotion against grievances that individuals had against the government, (Kim 2018). These two studies if applied to a contemporary Latin American context would indicate that at least in the psychological and social sense, the anti-government protests are occurring as a

psychological response to perceived grievances and are being used to vent emotion towards their government about the grievances they've endured, not any particular ideological gripes with the government.

One final piece of the social element explanation as to why anti-government protests are occurring would be Latin American citizens' opinions of Latin American anti-government protest. In Mourao's (2016) study, Mourao found that after extensively surveying Latin American citizens, as long as anti-governments protests remain peaceful and legal, Latin American citizens have come to see these protests as normalized within society. This normalization of anti-government protest in Latin America would reflect a societal legitimization of expressing grievances against governments, (Mourao 2016). The normalization of these anti-government protests would indicate in Latin America that in the absence of expressing grievances and complaints against the government in a meaningful way through conventional and institutional means, Latin American citizens have resorted to using anti-government protest as a means to vent their emotions where other means just aren't effective in that regard.

II) Political/Institutional Elements

In the realm of Political/Institutional elements, the strength, or lack thereof, of the political institutions is one of the main factors of current literature that drives explanations behind contemporary anti-government protests. On the one-hand, many institutional explanations revolve around the weakness of political institutions that give citizens an incentive to protest. Acre's (2010) study shows this concept in force; the study showed that there was a direct link between a Latin American country's political party strength and the level of protests activity. This study showed that in 17 Latin American countries, the trend denoted that the stronger political party, the rate of anti-government protest incidence would be much lower, (Acre 2010). A similar situation was observed by another study looking into the dynamics of protest incidence and political institutions strength. The study found that there was a correlative link between the perceived strength and legitimacy of political institutions and the level of protest incidence; when Latin American citizens believed that their political institutions were strong and operating in their favor, the level of protest incidence dropped significantly lower than when citizens believed their political institutions were weak or viewed as illegitimate, (Machado, Fabiana, et al. 2011). Lastly, this trend of weak institutions providing the catalyst for protest continues when looked at in the context of game theory; another study observed European protests through the lens of game theory and came to the conclusion that protestors often times will choose to protest when they believe that their government would be weak enough to bend to their demands or that there is precedent that would create a reasoning that would suggest that they would be have the opportunity for political change, (Buenrostro 2006). This pattern of weak political institutions and the higher incidence of protest would suggest that the weak political institutions not only set a precedent that traditional political institutions are no longer able to function correctly, but it also creates implications of political opportunity through extra-institutional means that protestors would attempt to capitalize on. The perception of governments/institutions as weak as an explanation is further strengthened by a study that denoted that Latin American governments will actively try to maintain the perception of strength and ability; this is evidenced as an ever increasing number of Latin American governments have criminalized public protests in an effort to appear strong and capable in the wake of mounting "from below" opposition movements, (Doran 2017).

The relationship between institution strength and anti-government protestors can be considered u-shaped however; institutions that are perceived as too strong also lend themselves to higher incidence of anti-government protest. This is evident in a study that analyzed the rate of anti-government protest incidence and the size of legislative coalition size. The study found that regardless of party type, Latin American legislatures who have legislative coalitions or overemphasized majorities that exceed 55% of the legislature have a distinct correlation to an increase in anti-government protest that is significant, (Garcia 2017). This would suggest that akin to weak political institutions, in the eyes of Latin American citizens, political institutions that become too strong are no longer serving the people and would come with a whole set of political grievances that would also serve to fuel political mobilization against the government.

Another important aspect of the Political/Institutional elements of explanation regarding anti-government protest would be the role that opposition groups play in the proliferation of anti-government protest. In Su's (2015) study, he found that among 107 democracies, the existence of opposition groups as catalysts for political protest better explained the determinants of political activity and the uptake of anti-government protest. This study also found that when opposition groups are unified against the government, the protest incidence would increase and the mobilization capacity is increased; it is noted however that the mobilization capacity of a country plays a much larger role in the incidence of anti-government protest in developing countries as opposed to developed ones, (Su 2015). This would compound the conclusion set forth in a study that looked at the role of opposition groups when autocratic regimes open up the country to multi-party elections. The study found that when these elections are opened up, opposition groups and social movements would partner together and there would be a serious uptake in anti-government protest due to the resulting window of opportunity that is opened and these anti-government protests would continue as long as there is a prospect for victory or until they believe they have received fair treatment, (Trejo 2014). Both studies view opposition groups in a country as a catalyst for political mobilization and the organizers behind anti-government protests that when applied to a Latin American context could help to explain the proliferation of anti-government protest.

III). Technological Element

In regards to the Technological element, namely social media, scholars have put forth that social media has had a hand in affecting anti-government protest incidence. A study found that in regards to the core-periphery dynamics of protest, social media political posts have been used as a strong tool for the periphery protestors in order to help the mobilization of people and resources for the anti-government protest, (Barbara, Pablo, et al. 2015). Furthermore, the study found that social media when used by low commitment and periphery protestors is able to amplify the position of the core protestors and creates a type of cascading effect that causes many to become committed core protestors, (Barbara, Pablo, et al. 2015). The idea that social media can be used as a mobilization tool coincides with another study that aimed to look at the role that social media layed in Latin American

anti-government protests. The study found that while moderate anti-government protests were aided by the mobilization capability that social media offers, the benefits did not extend to radical protests to the same degree, (Mourao 2016). These findings would suggest that although social media does have a part to play in the ability for the mobilization of anti-government protests, there are other factors that would need to accompany these factors to make a significant difference.

IV) Economic Elements

In the economic sector, there are a myriad of interconnected and dynamic elements that all relate to the economy yet in some cases blur the line with some political aspects as well. First, in a study analyzing some of the economic factors that push Latin American citizens to protest, it found that down turns in the economy or individuals with higher redistributive preferences were the most likely to protest against the government, (Justino, Patricia, Martorano 2019). This would indicate that at least on some basic level the state of the economy regardless of economic ideology is a prime motivator for Latin American citizens to protest against the government, especially when the economy is not doing good.

In regards to academic literature that has put forth economic explanations for anti-government protests, the nature and role of Neoliberal economic policy in catalyzing these protests is one of the most contentious points of explanations. On the one hand there are proponents who hold that neoliberal policy would serve as a catalyst for anti-government policy because of the nature of austerity measures. A study that investigated whether or not economic liberalization had an effect on anti-government protest, found that rather than demobilize the people, it actually served to increase political activity as citizens felt the need to resist or modify economic policy that would be affecting their lives, (Bellinger, Paul, Acre 2010). This idea that economic liberalization is a motivating factor for anti-government protests coincides with another study that analyzed Chilean University Students and their rate of protest; it found that there were distinct correlations between working class students and students with debt and their rate of protest against the government due to neoliberal policies, (Pavlic 2018). Furthermore, another study found that neoliberal policy and austerity measures would agitate anti-government protests because of the fact that working-class and public-sector employees were the ones who would be directly affected by those austerity measures and had their livelihoods threatened, (Almeida 2007). In all of these aforementioned studies, the consensus is that neoliberal policy and their austerity measures are instigative of anti-government protest because of the fact that they are directly threatening the livelihood of working-class and public sector citizens, and as such they are attempting to voice their grievances against the government for implementing policy that goes against the people.

There is literature however that is in opposition to the notion that neoliberalism and economic liberalization is a catalyst for anti-government protest. Specifically in refutation to Bellinger, Acre, and Paul's 2010 study, this study pushes instead that it is not economic liberalization that is a catalyst for anti-government protests, but rather other political elements at work that would lead to citizens protesting against the government, (Solt, Kim, et al. 2014). This study held that the pattern found in Bellinger, Acre, and Paul's 2010 study was reflective not of the economic liberalization policies in Latin American countries,

but that the pattern is more in line with the nature of Latin American autocracies; the study holds instead that it is not economic liberalization that is the arbiter of anti-government protests but rather Statist economic policies in Latin American autocracies that would explain the pattern of anti-government protests found in Bellinger and Acre's 2010 study, (Solt, Kim, et al. 2014). Under this school of thought, it is not economic liberalization or Neoliberal policies that prompts citizens to protest against the government but rather other compounding political factors such as the existence of an autocratic government and their economic policies that would serve as a justification for anti-government protest.

The academic literature surrounding the economic elements of the explanations for why anti-government protests occur also factors in the specific demographic of citizens that are involved in these protests. First, a 2020 study into the dynamics of anti-government protest actually necessitated the creation of two separate categories of protest: survival protest, referring to protest against direct threats to citizen's material and social survival, and furtherance protests, a protest that seeks to push the government to improve some aspect of the society, (Somma, Nicolas, et al. 2020). The study found that in regards to survival protest, this type of protest actually attracted citizens that were close to the national average income while the furtherance protests were attracting citizens from the higher socioeconomic echelons of society; the pattern that the scholars put forth is that higher access to socioeconomic resources would lend itself to increased participation in furtherance protests as opposed to survival protests because citizens in the higher socioeconomic brackets have much less incentive to participate in survival protest, (Somma, Nicolas, et al. 2020). The findings from this study are aligned with the findings from of Zarate-Tenorio's (2019) study; her study found that when Latin American protests against the government are on the basis of state-targeted grievances and are coupled with the availability of material resources, the citizens who are most likely to protest against the government were the ones who were the closest to the middle of the income distribution of their respective Latin American country. The reasoning behind this is as follows: the poor are unable to protest against the government because they lack the material resources required for organization and effectiveness while the rich are not incentivized to protest because they already have an abundance of resources, (Zarate-Tenorio 2019). Both studies would suggest that when the grievances towards the state are economic or resource based, the grievances serve as a motivator for anti-government protest in the highest degree for Latin American citizens of the middle class and median income distribution. Finally, within the explanations encompassed in the economic elements category, there is necessity to note the role that organized labor groups play in the incidence of anti-government protest. Zarate-Tenorio (2014) notes that in Latin America, organized labor groups play an extremely potent role in the nature of anti-government protest because of the fact that they are so intertwined with the economic and social facets of the country; she holds that these labor groups are some of the most powerful political organizers and their actions have long term positive effects in the realm of government sanctioned social spending. Another key finding that resulted from this study was that large-scale protest, especially those with involvement with organized labor groups, have created a deterrent effect in Latin America that discourages governments from cutting human capital spending, (Zarate-Tenorio 2014). This study would suggest that organized labor groups play a critical role in the dynamics of Latin American anti-government protest.

V) Conclusion

In looking at the main literature that encompasses the nature and factors that contribute to anti-government protest incidence, the four main categories of literature are: the Social Elements, Political/Institutional elements, the Technological elements, and Economic elements. The Social category encompasses literature that analyzes the role of community values, psychological/individual justifications, the imaginary, and the normalization of anti-government protest in Latin America. In the realm of Political and Institutional explanations, the literature analyzes the perceived strength/weakness of political institutions and the government as a whole, and the role that opposition groups play in serving as a catalyst and organizer of anti-government protest. Further, considerations for the role social media play as a mobilization tool for anti-government protest are analyzed in the literature that encompasses the Technological category. Finally, the Economic elements in explaining the incidence of anti-government protest factor in the role of Neoliberal policy, a refutation of the role of Neoliberal policy, individuals with redistributive preferences, the demographics of citizens most inclined to participate in anti-government protests, and the role organized labor groups play in the mobilization and incidence of anti-government protest. These are explanations put forth by scholars to help explain the factors and elements that play a role in answering why protests against the government occur.

Methodology

Research Question: Why are the contemporary Latin American anti-government protests occurring?

Dependent Variable:

In this research project, my focus is on contemporary Latin American anti-government protests. In Latin America, there has been a proliferation in the incidence of anti-government protests in the contemporary era. This paper is going to concern itself with the major protest movements that are currently going in Latin America; as such the dependent variable will be major protest movements. To measure my dependent variable, I will use data that is publically available from The Armed Conflict Location & Event Data Project (ACLED), specifically its data concerning Latin America. The organization's free data set can be accessed at: https://acleddata.com. In order to access protest incidence data prior to 2019, I will also be using information that is free to access from Harvard that concerns Mass Mobilization protest that can be accessed at: https://dataverse.harvard. edu/dataset.xhtml?persistentId=doi:10.7910/DVN/HTTWYL I will examine the incidence of anti-government protests from the beginning of these datasets to use as a test for my explanatory variables.

Explanatory variables:

In this thesis, I take a look at the variety of scholarly arguments that analyze the factors that result in the incidence of anti-government protests. In the literature review, the biggest elements were: political factors, economic factors, and social factors.

When looking at the social factors, I will make use of the various surveys and questionnaires that are available from the World Bank, specifically the Worldwide Governance Tndicators. Their data can be accessed from https://info.worldbank.org/ governance/wgi/ and will be used in order to take a look at the perceived reputation and strength of Latin American governments from the case studies.

When looking at the social factors, I will make use of the various surveys and questionnaires that are available from the World Bank, specifically the Worldwide Governance Tndicators. Their data can be accessed from https://info.worldbank.org/ governance/wgi/ and will be used in order to take a look at the perceived reputation and strength of Latin American governments from the case studies.

In regards to the political elements, I draw upon the existing literature in order to investigate political pieces of the question; Institution composition and strength, and the existence of major opposition groups and their ability for existence. In regards to Institutions, the legislative institutions of the case study countries will be analyzed for coalition size and perceptions of institution strength. Another factor I will look at in order to analyze political institution strength would be governance ability and strength; for the purposes of looking at governance, I will again be utilizing survey results on the governance ability from the World Bank, accessible from https://info.worldbank.org/governance/wgi/. Further, each case study country will be analyzed if there is a major opposition group or not operating in the protest movement and the circumstances of their operations; that being whether they are allowed to be there or not how they coincide with the economic theories of why anti-government protests occur. Specifically, I will be using information from the Heritage Foundation in order to see how each case study country's economic policy stacks up in economic openness and how it connects to the ideas of economic openness and correlation to protest incidence. The Heritage Foundation database can be accessed for free from this link: https://www.heritage. org/index/

Methodology:

In this thesis project, I will be using qualitative methods to come to a conclusion. I will be using two case study countries in a most different design for this research. Regarding the explanatory variables, I will be able to control for survey responses, Economic policies, political institutions, and finally the existence of opposition groups and circumstances. My dependent variables will not vary however my independent variables may vary only in the realm of the opposition group question due to the different governing types of Chile and Nicaragua.

Case Selection:

In this thesis project, I will be examining two different countries; Nicaragua and Chile in a most different design. Chile is Latin America's highest-ranked country on the Human Development Index while Nicaragua is one of its lowest-ranked countries. Further, Chile is a liberal democracy that is seen as a triumph for democracy in the region, with exception to its Pinochet past. Nicaragua on the other hand is an autocratic regime that has struggled to maintain the integrity of its democracy since the end of its conflict with the Contras. In many ways, Nicaragua and Chile differ, however they have both had a high incidence of anti-government protests in the contemporary era. The purpose of choosing a "most different" research design is to look at the political commonalities that Latin American countries share when it comes to anti-government protest, especially considering that Latin American countries are very different.

Pathway of Analysis:

    In the context of Nicaragua, I will take a look at how the economic policies, political institutions, opposition groups, and the survey responses. Of specific importance, the autocratic nature of Nicaragua's government will be analyzed in the context of the aforementioned explanatory variables. A differing explanatory variable will look at how opposition groups in autocratic regimes affect the incidence and mobilization of anti-government protests when multi-party elections are allowed.

    In Chile, there will be an examination of the aforementioned explanatory variables with the exception of the explanatory variable that depends on an autocratic regime; instead, it will be looking at the role of opposition groups in liberal democracies in the incidence of protest.

Analysis & Findings
Economic Elements:

A). Nicaragua

    In the realm of explanations in academic literature for the incidence of anti-government protest, one of the most forthcoming factors involves the role of economic performance and policy that acts as a motivator for citizens to protest in the streets. Specifically referring to the role that economic openness and neoliberalism in the nature of Latin American politics; many scholars put forth the idea that economic openness and neoliberalism are catalysts for protest while others rebuke that idea and instead believe it to be authoritarian regimes who are instilling statist policy. The Heritage Foundation, a conservative think tank that has created a database and analyzes the economic openness of every country, has a variety of different indicators that are useful for the purposes of looking at economic policy; business freedom referring to levels of privatization in the economy and levels of regulation, labor freedom referring to levels of labor laws and regulation, and government spending referring to the score that reflects how much government spending is being allocated to human capital and infrastructure. In the case of Nicaragua, the Heritage Foundation provides a significant amount of information regarding the state of its economic openness and how it has evolved. Further, it should be noted that since the election of Daniel Ortega in 2007, there has been a push against neoliberal policies that was necessitated in order to maintain his reputation as a Pink-tide leader and as a "champion of the people". The trends in Nicaraguan economic policy since 2007 for the most part reflect this idea that the government has been pushing an economic policy that runs counter to the ideas of economic liberalization, yet they are not taken to an extreme opposite.

Figure 1.

Labor Freedom Score for Nicaragua 2005-2020

Note. Labor Freedom scores for Nicaragua from 2005 to 2020. From the Heritage Foundation economic openness database (2021).

Figure 2.

Business Freedom score for Nicaragua 2005-2020

Note. Business Freedom scores for Nicaragua from 2005 to 2020. From the Heritage Foundation economic openness database (2021).

Figure 3.

Government Spending score for Nicaragua 2005-2020

Note. Government Spending scores for Nicaragua from 2005 to 2020. From the Heritage Foundation economic openness database (2021).

For instance, figure 1 indicates that since Ortega's election in 2007, there had been a definitive downward trend in the levels of labor freedom, to the point where the database would classify it as a mostly un-free system, (Hertiage Foundation 2021). Further, in the realm of business freedom, though not entirely rooted in anti-austerity policy, the higher rate of government regulation present in figure 2 is a phenomenon that is constant that places it as "mostly unfree", even in the periods 2015-2018 when the freedom increased considerably, (Heritage Foundation 2021). Finally, figure 3 indicates that the level of government spending since the election of Ortega in 2007 has remained relatively steady with the exception of 2013, (Heritage Foundation 2021).

Figure 4.

Mass Mobilized Protest incidence in Nicaragua 2005-2019

Note. Mass Mobilized Protest incidence in Nicaragua from 2005 to early 2019. From the Mass Mobilization Protest Database by Clark and Reagan, Harvard Dataverse (2021).

Figure 5.

Protest, Riot, and Political Violence incidence in Nicaragua 2019-2020
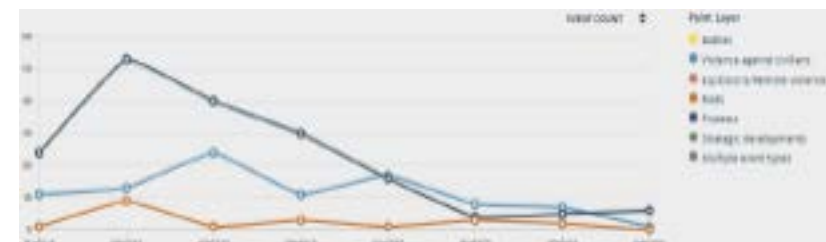
Note. Protest, Riot, and Violence Incidence in Nicaragua from January of 2019 to October of 2020. From the ACLED database (2021).

According to figure 4, the rate of protest incidence from the time of Ortega's election in 2007 remains relatively low with some discrepancies until 2018, when the protest incidence increases dramatically. Should the theories that scholars like Almeida, Acre, Pavlic, and others put forth regarding the ideas of economic liberalization and its effects on protest incidence be invoked, the proliferation of protests in 2018 would be difficult to explain under neoliberal economic conditions. The labor and business freedom scores for 2018 had remained part of a trend that cemented Nicaragua's economic policy as contrary to neoliberal and economically liberal policy, and the trend of government spending had not changed much since 2015, (Heritage Foundation 2021). Instead, the increase of protest

incidence in Nicaragua in 2018 may be reflective of the explanation put forth by Solt, Kim, and others in their 2014 study that held that it is autocratic regimes that are pushing statist policies that leads to a proliferation of protest incidence. Their explanation is partially reinforced due to the fact that the catalyst for the 2018 protests was the nature of Social Security reforms; the reforms would have increased the taxes paid for social security programs while removing a significant number of citizens from eligibility to receive such benefits, (Carnegie Endowment 2020). Furthermore, the actual spending of the Nicaraguan government had been steadily increasing, though marginally, prior to the 2018 protests as evidenced by the scores from the Heritage Foundation (2021) as noted in figure 3; this would be problematic for the ideas put forth by scholars such as Pavlic in his 2018 study or Bellinger, Acre, and Paul in their 2010 study in which they put forth that austerity measures that threaten citizens' livelihoods would be instigative of protest incidence. Following the logic put forth in these explanations, one would expect that major protest incidence to have occurred in the time between 2013 through 2014 when government spending was cut significantly as evidenced by figure 3. However, in that time frame, no major protest incidence occurred that would appear to support the aforementioned explanations that austerity measures and economic threats to livelihood are catalysts for protest incidence. Though the Nicaraguan case study provides more evidence for the Statist explanation, ultimately the Nicaraguan case study does not provide enough support for any singular explanation.

B). Chile

The Chilean economic policy could be one that is described as much more economically liberal than many other Latin American countries. With Pinochet's military coup in 1973, the country began to incorporate a significant amount of neoliberal reforms and overhauls; the significant influence of the "Chicago Boys" and dramatic privatization, as well as economic liberalization, led to many calling Chile the "neoliberal laboratory". Since then, Chile has maintained a primarily economically liberal policy, even in times of leftist administrations. Chile has remained a bastion of economically liberal policy within the region and the Heritage Foundation's economic freedom scores definitely reflect that.

Figure 6.

Labor Freedom Score for Chile 2005-2020
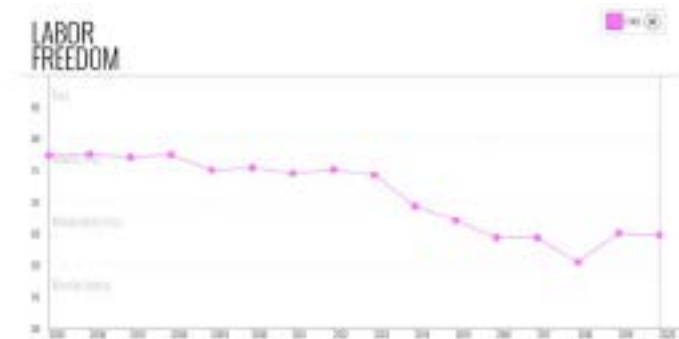
Note. Labor Freedom scores for Chile from 2005 to 2020. From the Heritage Foundation economic openness database (2021).

Figure 7.

Business Freedom score for Chile 2005-2020
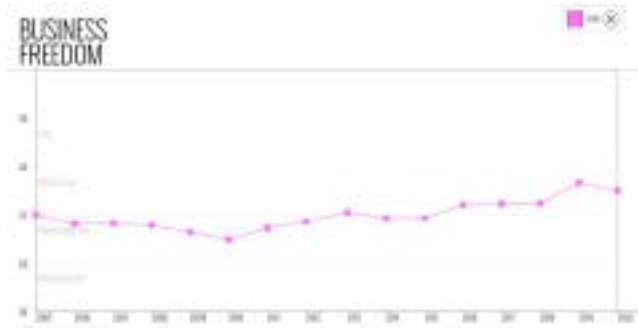
Note. Business Freedom scores for Chile from 2005 to 2020. From the Heritage Foundation economic openness database (2021).
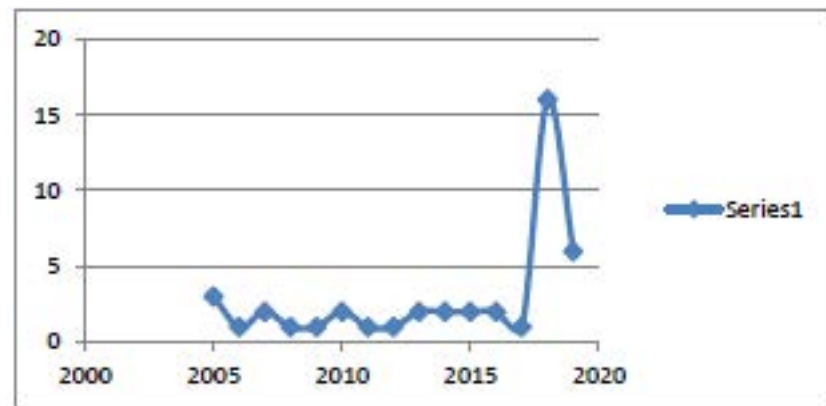
Figure 8.

Government Spending score for Chile 2005-2020

Note. Government Spending scores for Chile from 2005 to 2020. From the Heritage Foundation economic openness database (2021).

Figure 9.

Mass Mobilized Protest incidence in Chile 2005-2019
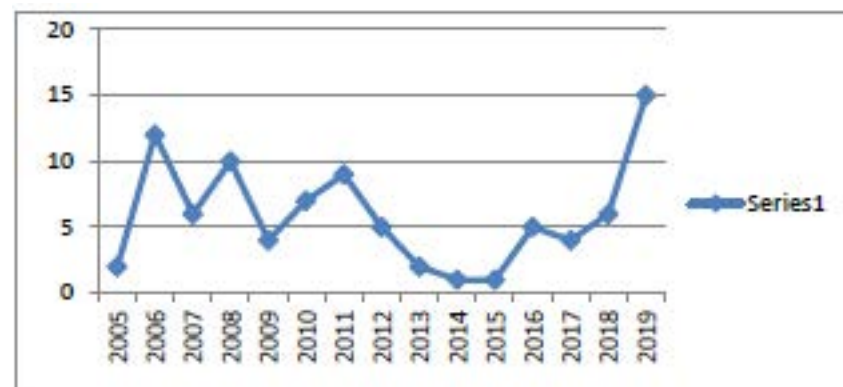
Note. Mass Mobilized Protest incidence in Chile from 2005 to early 2019. From the Mass Mobilization Protest Database by Clark and Reagan, Harvard Dataverse (2021).

Figure 10.

Protest, Riot, and Political Violence incidence in Chile2019-2020
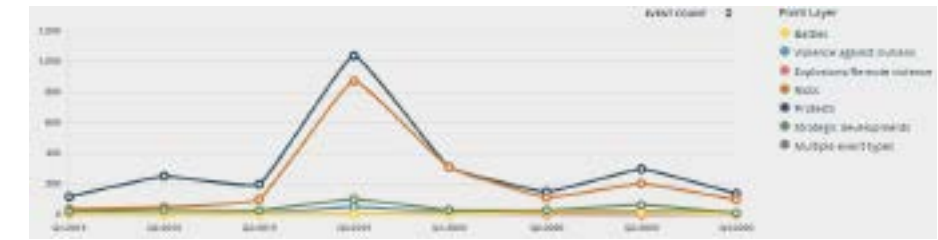
Note. Protest, Riot, and Violence Incidence in Chile from January of 2019 to October of 2020. From the ACLED database (2020).

In the case of Chile, there is a distinct and prevailing trend when it comes to the economic openness of the country; the trend shows that even in the times in which it dips, the Chilean economy is still firmly on the side of economically liberal. This trend is strong from the time in which the data starts, in 2005, all the way up to 2020, (Hertiage Foundation 2021). According to scholars like Almeida or Acre, protest-incidence should occur during times in which neoliberal policy is significantly increased as this would affect many citizens' livelihoods with the cutting of many social programs. However, in the Chilean case neoliberal policy is consistently high since the beginning of the data. Even in the era of Bachelet, a leftist president, the economic policy remains consistently neoliberal. Ironically, the major spike in protest incidence that occurs around 2019, as seen in figure 9, comes at a time in government spending and labor freedom that is downward trending, rather than increasing economic liberalization, (Hertiage Foundation 2021). However, seeing as the catalyst for Chilean Protests in 2019 was an increase of the Santiago Metro subway fare, neoliberalism may still pose a role in the proliferation of protest incidence in the indirect consequences that such a policy may have, (BBC 2019). In Chile, neoliberal economic policy is something that looms large and is ever-present in its politics and economy; it has become a part of the social reality in Chile. It is for this reason that neoliberalism may be considered as a necessary but not sufficient ingredient to the nature of protest incidence. In combination with other factors, neoliberalism may lead to a rise in protest incidence, but in the case of Chile, direct neoliberalism does not seem to be the sole or even main contributor to the protest spike. As such, the Chilean case study does not find strong evidence that neoliberal policy is directly linked to spikes in protests as scholars like Almeida and Acre would put forth. Rather, this case study would find that in at least in the Chilean case, neoliberalism is a necessary but not sufficient part of the equation in the context of protest incidence.

Political Institution Strength

A). Nicaragua

Academic literature has also put forth multiple different explanations regarding the nature of political institutions' strength and their effect on the proliferation of anti-government protests. As was noted earlier, scholars like Acre put forth that when political institutions or party strength are weak, the protest incidence would increase as protestors would see that

as an opportunity to be able to push their demands. Conversely, when political institutions are considered too strong, that would also instigate protest-incidence as it would appear to the people that the government no longer works for them. Garcia (2017) specifically takes a look at the legislative body and how when a legislative coalition or a party controls more than 55% of the seats, protest proliferation increases significantly. In the Nicaraguan case study, the situation appears to be one in which the political institutions are perceived to be too strong and no longer working for the people. To begin, the Nicaraguan legislative body, a unicameral body called the National assembly, elects its deputies every five years along with the President in the general election. The most recent general election occurred in November 2016 and resulted in 71 out of the 92 available seats in the National Assembly to be delegated to the FSLN as well as Daniel Ortega winning his third consecutive term as President of Nicaragua. Though the FSLN had won the previous elections in 2011 for both the National Assembly and President, there was a marked increase in seats that the FSLN won in 2016. As a result, the current composition of the Nicaraguan National assembly sees the FSLN controlling a staggering 77% of the legislature. Furthermore, allegations of corruption against the FSLN and the main opposition party, the PLC, maintain that the FSLN has bought out or intimidated many of the PLC members; this would give them an even greater degree of de facto control in the National assembly, (Estepa 2011). Even if the allegations of corruption are omitted, that leaves the FSLN with 77% of the Assembly, significantly over the 55% threshold that Garcia put forth in his study. Figure 4 reflects this; in 2011 the FLSN gained above 50% of seats in the National Assembly and there were consistently anti-government protests. This is until 2017, where there is a dip, and then 2018 skyrockets the protest incidence. It is important note however that the Ortega administration is one that is difficult to call democratic. Freedom House's score for Nicaragua for 2017 was "Partly free" with a 47/100 and then significantly dropped for the 2018 year to "Not Free" with a 32/100, (Freedom House 2020). Seeing as in 2014, the Ortega administration removed the constitutional term limits for the presidency and the increasingly authoritarian nature of the government, the National assembly may for practical purposes be a rubber stamp of the Ortega administration. In addition, the Ortega Regime's response to the protests occurring in March and April 2018 may have furthered the narrative that the Administration as an institution had grown too powerful and was no longer serving the people. On April 18th, 2018, the police and authorities reporting to Ortega opened fire using lethal force on protestors and killed 26 people, (BBC 2018a). Immediately after, different media outlets began to be censored unconstitutionally and there was a crackdown. After these events, the protest incidence proliferated exponentially until the middle of 2019, as figure 4 notes. These factors give credence to the academic explanations that scholars such as Garcia put forth that a political institution's strength is correlated to protest incidence in a country. The Nicaraguan Case Study shows strong support for the political institution elements that affect the level of protest incidence in a country.

B). Chile

Chile on the other hand displays a different situation than what was observed in the Nicaraguan case study. To begin, Chile's legislative body relies on a bicameral system, and in neither is there a majority party of legislative coalition. As of the 2017 election, the Chilean Chamber of Deputies' biggest legislative coalition is "Chile Vamos" with 72 out of 155 seats; that would make up 46% of the Chamber. Similarly, "Chile Vamos" holds 19 out

43 seats in the Chilean senate; that being 44% of the Senate. In either case, the ruling coalition, "Chile Vamos", does not have more than 50% of the legislative seats meaning that in the Chilean Case Study, Garcia's position does not have strong support for the proliferation of protest incidence. That being said, it is important to note however that in the Chilean context, 45% is a very significant percentage, one of the largest in Chilean history. Chile Vamos is the biggest coalition by a significant margin, yet it just does not qualify as one of the major factors under Garcia's explanations However, the referendum for a new constitution which passed in October of 2020 could possibly be interpreted as not viewing the current government as legitimate, (BBC 2020). As it stands, however, the evidence as presented creates a situation in which the aforementioned explanations do not have explanatory power. Ultimately, the Chilean case study does not support the explanations put forth by scholars in explaining the incidence and proliferation of anti-government protests.

Social Perception of Government Element:

A). Nicaragua

In the social factors category, it is important to analyze the social perceptions of the governments of Nicaragua and Chile in order to put to the test the social explanations that account for the proliferation of protest incidence against the government. Specifically, the survey results are in regards to governance ability and reputation of the respective government in regards to citizen opinion; this would allow analysis of the government's perceived strength and its reputation. The World Bank utilizes six different indicators to analyze governance capacity; Voice/accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Nicaragua's scores for the governance indicators are as follows.

Figure 11.

World Wide Governance Indicators for Nicaragua 2006-2019
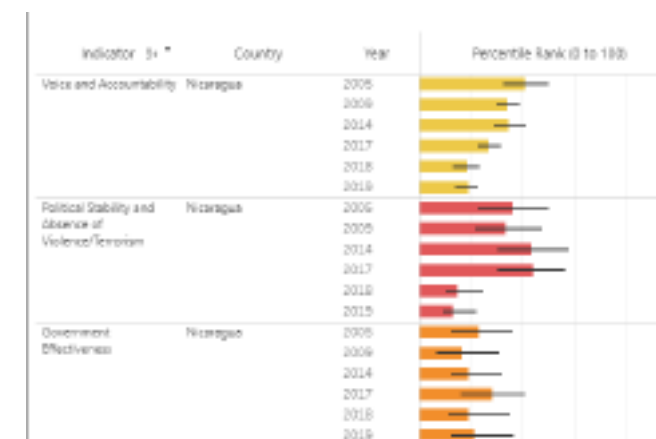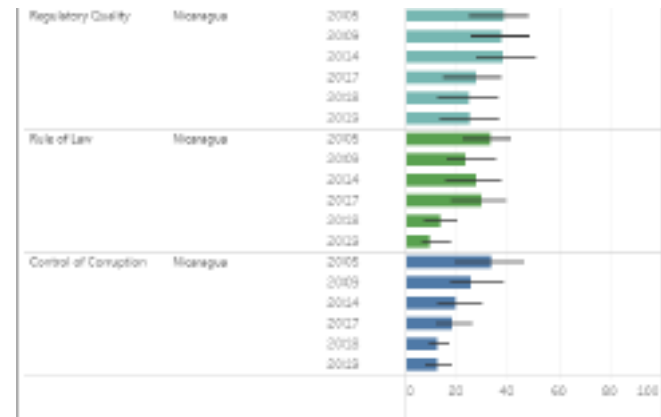
Note. Worldwide Governance Indicators for Nicaragua from 2005 to 2019. From the World Bank Worldwide Governance Indicators project (2020).

In the case of Nicaragua, there is a notable decrease in almost all categories of governance indicators from the 2017 year to the 2018 year results. The results of the governance indicators results would show support for a variety of explanations regarding the proliferation of protest incidence in Nicaragua. Firstly, Kim's explanation of the collective justification for protest is to voice to the government that it is citizens that are in control of the government and that the government should respect the people's demands seems to be supported. Seeing in figure 11, there is a steep drop from 2017 to 2018 in the categories of "control of corruption" and "voice and accountability"; this could indicate that the people no longer feel that that they are no longer in control of their respective government and are protesting in a bid to reassert more popular control over a government that became increasingly authoritarian. This explanation is strengthened in the context of the aftermath of the April 19th protests, which was one of the most visible examples of the Ortega regime becoming progressively more repressive and a possible to signal the populace that the government was taking increasingly greater strides away from popular control. Furthermore, these governance indicators seem to provide support for other explanations for the proliferation of anti-government in Nicaragua. The explanations put forth in the studies by Machado and Fabiana's 2011 as well as Buenrostro's 2006 revolve around the state's political weakness and actors taking advantage of such situations. When looking at the governance indicators, the indicators "government effectiveness", "political stability" and "rule of law", it becomes clear that in the perspective of the people, the government then appears to be weak and unable to conduct its operations properly. This would seem to support the explanation put forth by the aforementioned studies as in the eyes of the populace the government appears weak; perhaps weak enough that protestors believe that they would be able to force the government to cave to their demands. The game theory explanation seems to be especially pertinent when analyzing the effects of the aftermath of April 19th; the repressive actions of the Ortega Regime may have signaled that the Ortega regime is on the defensive and too weak to respond in any other manner. Interestingly, in the context of game theory, this would support the idea of a negative feedback loop that signaled even stronger to the populace that the government may be able to cave into demands which were taken advantage of by anti-government protestors. As a result, multiple explanations appear to be supported in the Nicaraguan case study when inspected in the context of social indicators; specifically the data regarding the perception of Nicaraguan's ability to govern.

B). Chile

The Chilean case study on the other hand appears to display a different situation when it comes to the social perceptions of Chile's ability to govern. Chile's governing score is as follows.

Figure 12.

World Wide Governance Indicators for Chile 2006-2019
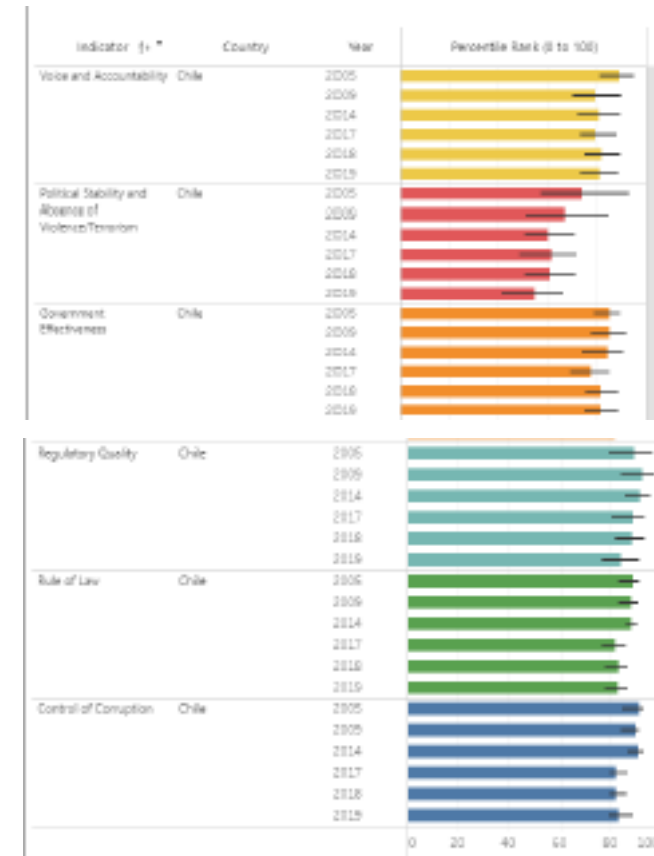
Note. Worldwide Governance Indicators for Chile from 2005 to 2019. From the World Bank Worldwide Governance Indicators project (2020).

In the case study of Chile, it is important to note that with the exception of "Political stability", all other governance indicators stable. In the case of "control of corruption", there is actually a slight increase while the realm of "government effectiveness" does not experience any change at all. Further, the indicators "of Voice and Accountability", "Regulatory Quality", "Rule of Law", suffer a decrease of less than 1, while finally "regulatory quality" decreases by less than 4. The most notable decrease in governance indicator score occurs in the realm of "political stability" by 5; this decrease in this indicator can most likely be attributed to the proliferation of anti-government protests in 2019 themselves. Seeing as the governance indicators remain relatively stable from the different years, it is difficult to note any support from the social elements that could function as explanations to the proliferation of anti-government protests in Chile starting in 2019. This creates a difficult situation for the explanations put forth by Buenrostro or Machado and Fabiana as the governance indicators seems to display a situation where these explanation are not

applicable. Having seen that the "government effectiveness" and "rule of law" categories remain stable, there is little support that the proliferation of anti-government protest could be attributed to a government weakness or game theory explanation; neither indicator would necessarily insinuate that the Chilean government is weak. Furthermore, the increase of the "control of corruption" and stability of "voice and accountability" actually seems to run counter to the explanations put forth by Kim; the indicators do not seem to support a narrative that the people no longer feel in control of the government. Ultimately, when it comes to the realm of the social perceptions that can be noted from the governance indicators, the Chilean case study does not create much support for any of the explanations put forth by scholars regarding how social perceptions lend themselves to proliferating the incidence of anti-government protest.

Opposition Group Element

A). Nicaragua

Regarding the Opposition group elements, this analysis will use the explanations put forth by Trejo and Su in a bid to see how the opposition groups specifically contribute to the proliferation of anti-government protests. Unfortunately, seeing as no opposition group database or other comprehensive information pool, this analysis will have to be done in a much more holistic and non-exhaustive manner that will focus on the major opposition groups. First, one of the most forthcoming explanations regarding the opposition group element in explaining the proliferation of anti-government protests comes from Su's 2015 study; this study put forth that when opposition groups are unified, the mobilization capacity would increase and that there would be a marked proliferation of anti-government protests as a result of this combined effort. In this respect, there is evidence to support such an explanation that the collaboration and unification of opposition efforts would lead to a proliferation of anti-government protests. Following the proposal, attendance, and subsequent cancellations of the national dialogues of May in 2018, there was the noted formal creation of various opposition groups that from then would become organized groups, (BBC 2018b). One of these major opposition groups would be known as the April 19th University Movement and would be a large coalition of student protesters from different universities around Nicaragua, (Velasquez, Barrios, & Celina, 2018). Another one of the major opposition groups that would be formed as a result of the national dialogue would be that of the Alianza Cívica, a very heterogeneous organization that would be considered a coalition of peasants, students, business sectors, human rights activists, and many more, (Alianza Civica, 2019). Interestingly, as is noted in figure 4, even after the formation of these groups, there is continued proliferation of protest activity in Nicaragua until January of 2019, in which there is a marked decline of protest activity. This would give credence to the explanations put forth by both Su and Trejo that the collaboration and organization of efforts of the opposition groups would allow for greater mobilization efforts which would lead to significant growth of anti-government protest. However, the contrasting point should also ring true; that ceased collaboration between opposition groups would then lead to a decrease in anti-government protests. On February 25th 2020, the formation of the National Coalition occurred; this national coalition was meant to unify most of the major opposition groups together in order to build support and strength between the opposition groups and for the upcoming 2021 General election, yet due to alleged internal power struggles,

corruption, and disputes the coalition would lose the Alianza Cívica, one of the most clout wielding groups, (Alvarez, 2019). However, Figures 4 and 5 show an opposite trend; around the same time of the formation of the National Coalition, there is a decrease in the level of protests and the time in which the Alianza Cívica is leaving the Coalition, there is an uprising trend on the level of protest. This situation would weaken the explanatory power of the explanations put forth by Su and Trejo. Another one of the important tenets of Trejo's explanation is that of the nature of victory prospect and treatment with respect; Trejo puts that opposition groups will continue to protest against the government so long as the prospect for victory is there or when they believe they have received fair treatment. In this respect, there are elements of the Nicaraguan protest timeline that would significantly strengthen Trejo's explanation. Probably the most forthcoming example of the fair treatment and respect for protestor idea can be seen in the events of April 19th, where the government and pro-government paramilitaries would gun down protestors around the country, (BBC, 2018a). The blatant murder of protestors goes completely against the idea of fair treatment for protestors and may have inflamed the protestors to not only continue protesting, but to proliferate the incidence of anti-government protest; this would support Trejo's explanation regarding the fair treatment of protestors leading to a decrease in protest. Another example, the suspension of the national dialogue on May 23, 2018, as the Ortega government believed that protestors were pushing a coup d'état agenda would support the Trejo explanation, (BBC, 2018c). Seeing the suspension of the national dialogue and the continued proliferation of anti-government protests after the dialogue as figure 4 notes, under the Trejo explanation this could be interpreted as the opposition groups continuing to feel as though they are not being treated fairly and are continuing to fight against the government through protest. This would strengthen the argument put forth by Trejo and has explanatory power on the continued protest proliferation until January of 2019. The victory prospect explanation may also the sharp decline in protests that occur at the beginning of 2019. Around the time at which the downward trend in 2019 is occurring, the Ortega Regime would expel all independent human rights investigation groups under the justification that they are "interventionists" coupled with continued systematic repression of all dissidents against the regime, (El Heraldo, 2018). This under the Trejo explanation could indicate that the opposition groups no longer believe that there is a current ability to achieve victory; the rejection of the independent commissions could indicate that the Ortega regime for all intents and purposes will not be willing to negotiate or allow anything that may undermine the regime. Further, the continued and in some cases increased repression against protestors could indicate that the protestors would not be able to achieve any type of victory in the near future and as such there would be no motivation to continue to protest against the government. Even in the face of some situations like the Alianza Cívica leaving the National Coalition, the Nicaraguan case study for the most part seems to provide evidence for the opposition group explanations put forth by Trejo and Su.

B). Chile

The Chilean case study analyzed from the perspective of opposition group explanation also demonstrates the possible factors that influenced the proliferation of the anti-government protest movement that started in Chile in 2019. On the question of Su's unified opposition against the government, this requisite would seem to be met. From the onset of the protest movement, the Chilean protestors have been extremely heterogeneous;

there are protestors from the lower and working classes, indigenous protestors, student protestors, some of the upper-class, and many other strata of society, (Johanson, 2019). However, it is important to note that, unlike the Nicaraguan case study, in the Chilean protests there have been no formally organized opposition groups or structures; no political party or leaders have emerged to call for a unified protest voice, (Johanson, 2019). That being said, the unified opposition that has occurred in Chile seems to corroborate the explanation put forth by Su, that it would increase mobilization capacity and the incidence of protest. The mobilization concept specifically seems to be in play here, because unlike the protest movements of 2011 or 2014 which were primarily student-based, the protests of 2019 had reached a record of more than 1 million people protesting at once; the sweeping inclusion of many other groups seems to support the mobilization aspect of Su's explanation and could explain why such a massive protest turnout occurred, (Johanson, 2019). Although Chile is not an autocratic state, the prospect for victory element of Trejo's explanation seems to have some credence in the Chilean case study. In the analysis of Chile's proliferation of protests, there are two main time frames, in figure 10, in which there are spikes of protests incidence, Quarter 4 of 2019 and Quarter 3 of 2020. These protest spikes coincide directly with important political decisions being made; on November 15 2019 the Chilean National Congress would agree to hold a referendum for a constitutional rewrite and on October 25 2020 the referendum was had, which passed with 78% in favor of a rewrite, (BBC, 2020). This situation would support the victory prospect element of Trejo's explanation; in this case study, the Chilean protestors were afforded opportunities to make the desired changes and the opposition groups would mobilize right before each of these decisions was made in order to make sure that they would be able to pass their desired outcome. As such, in both Su's explanation and the victory prospect element of Trejo's, the Chilean case study would seem to support the explanations.

Conclusion

Ultimately, regarding the theories that surround the nature of anti-government protests in Latin America, only those theories that surrounded the specific nature of opposition groups seemed to have evidence from both the Nicaraguan and Chilean case studies, (Su 2015 and Trejo 2014). However, that is not to say that the other explanations that the rest of the scholars put forth are null; in fact, many of these explanations when tested had evidence being supported in the Nicaraguan or Chilean case studies respectively. The difficulty with analyzing the nature of Latin American politics and protest arises in the fact that Latin America is not monolithic; the region of Latin America contains more than 20 countries and each one has its own unique history and respective issues.

After analyzing both the Chilean and Nicaraguan case studies for evidence that supported the explanations that centered around social perspectives, opposition groups, political institution strength, and the economic requisites, the only explanations that had bilateral support were those that revolved around how opposition groups interact with each other and the ruling government. On the question of the economic requisites, Nicaragua's economy is purposely being increasingly regulated in a bid to fight against Neoliberalism, while Chile's neoliberal culture is so entrenched that it becomes a necessary but not sufficient factor in the proliferation of protest; neither provided evidence for the economic explanations that were tested. Regarding the strength of political institutions, the Nicaraguan legislature and by extension government as a whole seemed to fit the bill regarding explanations by Garcia (2015) and Acre (2010) yet the Chilean case study did not

provide much strong support. Similarly, with regards to the social perspectives explanations that Kim (2018) Machado et al. (2011), and Buenrostro (2006), again the Nicaraguan case study provides strong evidence seeing as there were serious drops in the governance indicator survey results yet in Chile the survey results did not change significantly and does not provide support to the explanations posed by the aforementioned scholars. As was noted earlier, the explanations by Su (2015) and Trejo (2014) were the only theories that held constant between both Nicaragua and Chile; that the opposition group is one of the primary catalysts for anti-government protests and the manner in which they interact with each other and with the ruling government is crucial in analyzing the proliferation of protest. Following this, the reasons for why these protests occurred during these specific times and not much prior may also be explained through the opposition group explanations. Following Trejo's prospect for victory element of his explanation (2014), certain events may have been the opportunities or "protest casus belli" that legitimized and mobilized the populace to the opposition groups. In other words, groups who already had grievances with the social order and status quo would capitalize on events that create social unrest to organize and mobilize the populace; this type of opportunity is often the type that is needed for mass mobilization and often is the prime opportunity to launch a protest campaign with the most effectiveness. In the Nicaraguan case, the events of April 19th would create significant social unrest that opposition groups funneled and used to direct popular frustration towards the government, in the form of protest. In Chile, the price hike for the metro similarly was unpopular and groups would channel these grievances into protests against the government. In essence, these "trigger events" could be the signals to opposition groups that these are the most legitimizing opportunities for their endeavors and paints the prospect for victory in a manner that is more concrete but also creates the most favorable circumstances for these groups in terms of mobilization and popular view.

In many ways, these findings are able to be generalized to not only a greater Latin American context but also a global context as well. To begin, the explanations put forth for the opposition groups are not prejudiced to solely Latin America but are based around a much more global perspective. Further, the conditions that explanations set forth for explaining the incidence of protest are not based on the Latin American reality; the conditions are able to be found in any country around the world. These explanations are based on the existence, interactions, and psyches of opposition groups; opposition groups are entities that exist in almost every country and are not unique to Latin America or these specific case studies.

The results of these findings are important for a variety of reasons. Latin America is currently experiencing a wave of anti-government protests around the region, and understanding these protests will have explanatory power into the condition of Latin American governance. Further, many of these protests will have serious political, economic, and social ramifications on the future of Latin American politics and may in certain cases lead to regime changes or have spillover effects into their neighboring countries. Seeing the massive role of opposition groups in the proliferation of anti-government protests, understanding the psyche and action process behind opposition groups can help in not only analyzing anti-government protests, but also the aim, effects, and composition of the anti-government protests. In order to further the debate and analysis of the literature, the theory that was posed in this paper should be tested in the context of other Latin American states

in order to see if these explanations still maintain their explanatory power.

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Bickham   **Reducing Authorial Burden for Story Sifting: Creating a Kismet**
Charles   **to Felt Compiler**

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Social simulation has been a popular domain for computational creativity. Even though it is very simple to use for end users, in the past it has not been modifiable for the end users. Since Meehan developed TALE-SPIN there have been numerous applications that include social simulation which include stories, games, theatrical performances, and audio plays. We will be implementing Kismet which is a simple social simulation language. Even though it is not as powerful as other social simulation languages it leverages computational machinery and is authored using natural language inspired syntax that is designed to be end user facing The purpose of Kismet is to help distribute the authoring of scenario content modules, such as those in table-top role-playing games. There have been many unanswered questions about social simulation which include can someone with little to none programming experience create their own experience. It will be possible for someone with little to no programming experience to create their own Social Simulation using Kismet.

Felt is an existing social simulation engine that has been implemented and utilized in two games. However, the Felt comes with a high authorial burden, and requires a lot of boilerplate code to be copied for it to work. This boilerplate code can create a lot of issues for a novice author – What code should be copied? What pieces need to be changed? -- leading to difficulties in authoring. I intend to create a Kismet to Felt compiler, marrying the strengths of the two. An end user could author in the simpler to understand and write Kismet, while still retaining access to the complete Felt back-end. To test the compiler, I will use the two existing Felt games and assess the coverage of Kismet-to-Felt translation and compilation.

Significant progress on the Kismet to Felt Complier has been made. I have created a program that takes a file that is coded in ASP and is able to parse the statements to translate them into Felt. The program is also able to handle errors that will not be recognized by the Felt compiler.

ASP to Felt Translation

In the picture below it demonstrates the translation of a single line of ASP to Felt.

```
Kismet -> Felt
castable(patron,bar) -> '"patron" "castable" "bar"'
castable(bartender,bar) -> '"bartender" "castable" "bar"'
castable(owner,bar) -> '"owner" "castable" "bar"'
```

ASP to Felt Translation Error

In the picture below it demonstrates how the program handles an error of the Kismet 1
translation.

```
status(likes) -> None
Couldnt't parse status(likes)
```

The compiler also can parse complete actions. This process is done in the three steps.

1. Parse the complete the Action
2. Parse the statements within the Action
3. Translate into a complete Felt Action

During step one it parses each Action by taking the text between each period.

Then during step two it splits the string into two parts by ":-". The first half is the in the
format of action(mingle, Actor, Target, Observer, Location, Action) and is correlated to the
Felt "event". These values are then stored in a dictionary called "associateActions" with the
K\key being "mingle". The second half of the string are the ASP statements and is correlated
to the Felt "where". The ASP statements are each parsed and translated into Felt and is
stored into another dictionary called "whereMatch".

In the last step it then takes those values in "whereMatch" and "associateActions"
and translates the action into a way that Felt compiler can comprehend. In the picture below
it shows the complete translation from ASP to Felt.

ASP

```
action(barroom_brawl, Initiator, Combatant, null, null, Location):-
    person(Initiator),person(Combatant),person(null),event(null),location(Location),
    is(Initiator,dislikes,Combatant,V_Initiator_dislikes_Combatant), V_Initiator_dislikes_Combatant > 5,
    is(Initiator, drunk),
    is(location, bar),
    at(Combatant,Location),
    is(Combatant, drunk),
    at(Initiator,Location),
    different(Initiator,Combatant),
    different(Initiator,null),
    different(Combatant,null).
```

Felt

```
Felt.Register('barroom_brawl',{
where: [
    '"dislikes" ?initiator ?combatant',
    '(> ?V_Initiator_dislikes_Combatant    5)',
    '?initiator "is" "drunk"',
    '?location "is" "bar"',
    '?combatant "is" "drunk"',
    '(not= ?initiator ?combatant)'
],
event: (vars) => ({
    actor: vars.initiator,
    target: vars.combatant,
    location: vars.location,
    effects: [
    ],
})
});
```

Kismet to ASP to Felt

The next and final step is to do a complete translation from Kismet to ASP to Felt. The picture
below shows this process.

```
def translate_to_felt(kismet_file):
    # This makes a file called kismet_file_rules.lp
    kismetModule = KismetModule(kismet_file, ['../tracery/edwardian.tracery'],
                                ignore_logit=3.0,
                                observation_temp=1.5,
                                history_cutoff=10,
                                action_budget=3,
                                default_cost=3, )
    fileName = kismet_file + '_rules.lp'

    #Turn the file into text
    fileToText = fileToString(fileName)

    #Translate from ASP to Felt
    print(parseArgument(fileToText))
    print(feltActionsConvert(whereMatch,associateActions))
```

The code displayed is the translation from Kismet to ASP to Felt. The method takes in the name of the kismet file as a parameter. The variable KismetModule takes the Kismet File and generates a separate file that is translated to ASP. Once we have the ASP file we then translate it to Felt. The picture below shows an example of a full translation.

Kismet	ASP	Felt
action drink_the_day_away()>Person)	action|drink_the_day_away, Person, null, null, null, null].	Felt.Register('drink_the_day_away',{ where: [
"Person is lazy and goes to the bar to drink the day away":	person(Person),person(null],person(null],event(n ull],location(null].	'?location_0 "is" "bar"],
location: bar[Person];		event: (vars) => [(
tags: lazy, drinking;	is(Location_0,bar],	actor: vars.person,
result: Person is drunk.	at[Person,Location_0],	effects: [
	different[Person,null],	{type: 'addStatus', status: '',
	different[Person,null],	source: vars.person, target: vars.drunk]
	different[null,null].	],
		}]
		});

In conclusion, I have created a Kismet to Felt complier that will allow the user to author their own experience without worrying about the complex authorial burden. In the future I would want to test the hypothesis that Kismet reduces the authorial burden for a user.

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The Effect of Cold Plasma Application on Long Chain Cyanoacrylates for Enhanced Adhesion

Abstract

Cyanoacrylates are a group of strong, fast-acting adhesives. Short-chain cyanoacrylates (SCCAs) have -been contended by researchers to be more adhesive than long-chain cyanoacrylates (LCCAs) and thus more reliable; however, SCCAs are known to cause tissue toxicities and have been replaced by LCCAs for medical purposes. Currently, LCCAs are primarily used in wound healing, but are also used in research procedures such as installing cranial windows. This study will focus on using cold plasma to increase the adhesiveness of the tissue safe LCCAs. Over the last few decades, cold plasma has emerged as a focus of research in the biomedical field. Cold plasma has the ability to alter the surface characteristics such as wettability and sterility. The study will observe the effect of cold plasma on the adhesiveness of LCCAs on two groups of CD1 mice (chosen to minimize genetic variability). Both groups will receive a pre-set amount of LCCA on their skulls followed by the attachment of a 1mm strip of metal. The experimental group will be treated with cold plasma prior to receiving their LCCA and metal strip application. The LCCA will be given 3 minutes to set before the metal strips are hooked onto a digital force cage. The force required to break the adhesive skull-metal bond will be recorded for each mouse and compared. If the experimental group yields higher forces required to break the bond, this study will serve as proof of concept that cold plasma can increase the adhesiveness of LCCAs in medical applications. We predict that with a smaller contact angle from decreasing wettability, the LCCA will spread more thoroughly, and its overall adhesion will increase.

Major objective

Our major objective is to understand the adhesive-enhancing features of cold plasma. We seek to improve the adhesiveness of skin glue, which is currently not as adhesive as it could be, with an application of cold plasma.

Background research with analysis of literature review

In the past, short chain cyanoacrylates (SCCAs) were used as tissue adhesives; however, as they degrade rapidly, it was found that they result in tissue toxicities (Chou, 1977). Currently, long chain cyanoacrylates (LCCAs) are used in place of the SCCAs because they degrade slower, thus avoiding tissue toxicities, and are safer for use (Singer et al., 2007); however, when comparing the SCCAs and the LCCAs, it has been contended by researchers at UCLA that despite resulting in tissue toxicity, the SCCAs are more reliable than the LCCAs (Sohn et al., 2016). It is consistent to say that LCCAs work similarly and more safely than SCCAs but may not be as effective when it comes to adhesiveness. More recently, technology has brought us the application of cold plasma to treat surfaces in order to enhance their wettability, virtually making surfaces more adhesive on command (Károly et al., 2019). To our knowledge, there is no experimental data on the effects of cold plasma on LCCAs and their adhesive properties. The question which we aim to answer in our research is whether we can enhance the adhesiveness of LCCAs without causing detriment to patients.

Cyanoacrylates have been used in the medical field since as far back as 1958 with

with the first successful wound closure following in 1959 by Coover et al. Over the years, cyanoacrylates were noted to have similar levels of infection and wound dehiscence as sutures. However, the cyanoacrylates provided quicker wound closure and excellent aesthetics unlike sutures. Cyanoacrylates form antimicrobial barriers at their application site, specifically against gram-positive bacteria which make up a large percentage of wound infections, which is notable in its ability to treat, heal, and close wounds. A few advantages of cyanoacrylates include not needing local anesthetics, saving money on overall the cost to treat, preventing needle sticks, high and quick medical proficiency, and quicker operative times for long incisions. Disadvantages of cyanoacrylates in medical practice include the inability to apply over surfaces with hair and not being effective at treating areas of in need of high tensile strength (Singer et al., 2007). Originally, cyanoacrylates were largely used in dentistry. In the 1960s, cyanoacrylates were used in experiments with patching, anastomosis, and shunting the arteries and veins of dogs; however, surgical use of cyanoacrylates proved detrimental to patients as it caused tissue toxicities and triggered inflammatory responses. By 1971, researchers had begun to note that the longer the chain was in the cyanoacrylates, the fewer issues were present (Raja, 2016). Benefits of cyanoacrylates in medicine over sutures include: faster repair times, needles are not required, patients are often easily accepting, it quickly and firmly bonds, does not require the removal of sutures, and more (Bruns and Worthington, 2000).

While cyanoacrylates may be favorable over common sutures for the previous reasons stated, the chain length of the cyanoacrylate alters its effects greatly. In a study by Singer et al (2008), cyanoacrylates as skin adhesives were investigated and compared closely. Singer noted that long-chain cyanoacrylates were more likely to fail when frequently exposed to moisture and should not be used on or near mucus membranes. Singer also noted that short chain cyanoacrylates, once polymerized on a substance, form strong and tight bonds. These strong, short chain bonds were preferred when bonding occurred at an interface. The downside of the short chain cyanoacrylates, when used as a topical bridge, was that it formed brittle bonds that would often break prematurely. In other words, when used topically, the shorter chains tended to result in cohesive failure. In the same study, the long chain cyanoacrylates were noted to result in interfacial failure as the adhesive was peeled away from the skin. Adhesion refers to the ability of molecules to stick to different surfaces, while cohesion refers to molecules ability to stick to each other (of the same substance). While both adhesives were noted to fail under certain conditions, the long-chains were more likely to fail due to adhesion rather than cohesion which was the more likely failure of short-chain cyanoacrylates. This is relevant to our study because we are investigating the adhesion of long-chain cyanoacrylates, which Singer has noted to have a higher tendency to result in adhesive failure than their short-chain counterparts.

When cyanoacrylates break down, they form cyanoacetate and formaldehyde. It is important to note that cyanoacetate is a known histotoxic irritant. In a study by Leggat et al. (2007), the toxicity of cyanoacrylates was analyzed in the medical workplace. The study showed ways of minimizing the reported toxicities associated with cyanoacrylates. Leggat found that the longer the cyanoacrylates degraded, the less toxic byproduct per unit of time was found. This is to say that the shorter chain cyanoacrylates, which degraded quickly, released this toxic byproduct onto the tissue in a shorter amount of time while the long chain cyanoacrylates gradually degraded, slowly releasing the toxic byproducts rather than all at

once. This ties into Singer's study as she noted any serious, toxic degradation occurred after the adhesive had already fallen off the skin—this is in reference to the slow degrading long chain cyanoacrylates.

Originally, short chain cyanoacrylates were thought to be nontoxic to tissue; however, in a classic study by Chou (1977), the SCCAs were found to cause numerous detriments such as causing inflammatory reactions in the arterial wall, histological changes, degenerative changes in the axons, and even pyknotic alterations in areas of the superficial layers of the cerebral cortex. While Chou, at the time, did not understand exactly why the short chain cyanoacrylates were causing detriments, she noted that perhaps due to aging, the agent was undergoing chemical changes.

Plasma has been a focus point of the science community over the last few decades; however, since plasmas are extremely hot gasses, the focus has turned to cold plasma. Plasma, both cold and hot, causes various reactions on tissue. In modern medicine, cold plasma is utilized in a large variety. Some of its modern uses include tumor excision, sterilization, diagnostics, and spacecraft propulsion to name a few (Purdue University, 2019). In fact, a study by Yan et al. (2019) noted that 30 seconds of cold plasma treatment led to three times more glioblastoma cell death when compared to HPC cells. Cold plasma can also inhibit pathways for glioblastoma cell survival and proliferation such as mitosis, meiosis, transcription, glucose metabolism, and more. By increasing the number of macrophages present, cold plasma can be used to release tumor necrosis factor. In rat models, cold plasma has been documented to inhibit the volume of tumors and prolong survival rates of rats with tumors underneath their skin. Another beneficial characteristic of cold plasma in efforts to combat glioblastoma is the reduction of chemotherapeutics needed. When paired with cold plasma treatment, the dosage of chemotherapeutics required greatly decreases—this leads to fewer detrimental side effects seen from the toxic chemotherapeutics in the body (Yan, 2019).

Additionally, cold plasma is currently used in dentistry to treat dental caries, biofilms, intraoral disease, restore adhesion, and to disinfect root canals. In a study by Arora (2013), researchers reviewed cold plasma applications in dentistry. Arora found that cold plasma could increase bonding strength at the dentin/composite interface by 60%. Additionally, this study found that cold plasma was an effective treatment for disinfecting and treating dental caries and root canals by penetrating irregular shaped spaces where microorganism often hide from current technologies. Another application of cold plasma has been highlighted in studies on biomaterials such as prosthetics and medical implants. In a study by Reyna-Martinez et al. (n.d.), cold plasma treatment on biomaterials were discussed to lead to increased hydrophilicity and antithrombogenicity—surfaces showed increased wettability and prevented formation of blood clots. In the same study, cold plasma was shown to prolong the loading capacity of antibiotics onto surgical meshes while maintaining antimicrobial properties, which led to fewer post-operative infections. Cold plasma is capable of pushing drug release beyond intrinsic capacities by increasing the porosity of drugs. A thin layer of plasma polymerization on the surface of these drugs acts as a barrier and prolongs the release (Reyna-Martinez et al., n.d.) More on the sterilization aspect of cold plasma, a study by Yu et al. (2006) looked at how cold plasma could be used on bacteria, specifically Escherichia and/or Micrococcus luteus. The study found that it took

approximately 3 minutes under cold plasma treatment for a complete kill. By clearing out bacteria on a micro scale, surfaces become more sterile. When we sanitize the surface from bacteria and microbes, we ensure it is clear of contaminants. In our study, we applied cold plasma to the tissue of euthanized mice.

We will look to see whether the cold plasma can increase the adhesion of the long chain cyanoacrylates on the tissue, which is a hydrophobic surface. Hydrophobic surfaces exhibit increased adhesion forces compared to hydrophilic surfaces. Cold atmospheric plasma was discussed in a study by Chen et al. (2020) to open hydrophobic functional groups on surfaces, allowing them to become temporarily hydrophilic. In a study by károly et al. (2019) noted cold plasma may increase the wettability of a surface, this is stating that a surface will become more easily wetted and liquid on the surface will have a lower contact angle—liquids on this surface will spread more thoroughly.

In our study specifically, we are aiming to answer whether a cold plasma treatment would enhance the adhesiveness of the long chain cyanoacrylates. We predict that the cold plasma will increase the adhesiveness of the long chain cyanoacrylates without causing detriment to patients. 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 I have taken during this period has been focused on better understanding plasma and the physics side of our project in preparation of the day we are allowed to carry out our project. I am presenting articles weekly to Dr. Abramzon and our lab on cold atmospheric plasma applications as they pertain to our project and learning more information to be prepared to operate with cold plasma.

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?

- Since our fall 2020 and spring 2020 have been virtual, our project has not seen much progress. We have not been able to carry out any aspect of the physical project as we are not currently allowed on campus. Still, we have been working diligently to be fully prepared for when the times comes. Our IACUC protocol has been approved and we are constantly adding literature in anticipation of data collection in the fall of 2021.

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Coronel Jessica

Dr. T. Osberger

Cyclic Dipeptide Synthesis: Laboratory Design

Abstract

An annotated bibliography of cyclic dipeptide candidate experiments was compiled through searching literature articles on Sci-finder. The scope of the articles focused on homocyclic dipetides including cyclo(ala-ala), cyclo(phe-phe), and cyclo(pro-pro). A cost estimation, chemical hygiene and safety, ease of completion, including time of completion, ease of purification, and characterization were evaluated to construct a shortlist of possible experiments to be conducted in the laboratory.

Acknowledgement

Introduction

Our research focuses on creating a lab design of a cyclic dipeptide synthesis to become a new lab manual experiment for organic chemistry. Cyclic dipeptides, also known as diketopiperazines, are two amino acids that link together via peptide bonds forming a heterocyclic ring. What we hope students can learn is the mechanism of our proposed synthesis where two amino acids undergo peptide coupling via an amide bond formation to form a linear dipeptide, which is followed by the deprotection of the protecting group, and then cyclizes to form a cyclic dipeptide/diketopiperazine. Another important aspect we want students to learn is that cyclic dipeptides are significant because of use in amide bond formation to create the linear dipeptide. According to the Journal of Medicinal Chemistry, 40% of the synthetic procedures of common pharmaceutical molecules use amide bond formation.[1] An important chemical property of cyclic dipeptides is the lack of charges at the amine and carboxyl terminal groups[2] and the lack of zwitterionic character makes it high lipophilicity and permeability, leading to fast absorption. Lipophilicity refers to the ability of a chemical compound to dissolve in fats, oils, lipids, and non-polar solvents. [3] Zwitterionic characteristic in molecule have functional groups, of which at least one has a positive and one has a negative electrical charge which adds up to a net charge of zero.[4]

What makes Cyclic dipeptides more significant is due to the fact that they are small, conformationally constrained heterocycle with a rigid backbone that mimics peptide secondary structure.[5] All of their six positions are easily modified, which allows them to have diverse substituent groups.[5] They are stable to proteolysis (enzymatic degradation),[2] which is the breakdown of protein into amino acids. Most importantly, the absence of planarity overcomes the limitation of its presence typically found in known pharmaceutical molecules.[5] Cyclic dipeptides were reported to have various biological activities including antimicrobial, antitumoral, antiviral, antibacterial activities as well as cytotoxic effects.[6] Therefore, cyclic dipeptides are useful in drug discovery and medicinal chemistry. Cyclic dipeptides are found in natural products produced by yeast, fungi, bacteria as fermentation

They are most commonly responsible for the bitter taste in foods and beverages such as roasted coffee, beer, Japanese sake, and chocolate[7] In chocolate or roasted cocoa, cyclo-(proline-valine) [8] is the cyclic dipeptide that is responsible for their bitter taste, and in beer or sake, it is cyclo-(proline-leucine).[9]

Annotated Bibliography

Experiment 1: Cyclic dipeptides exhibit potency for scavenging radicals

Tadashi Furukawa, Takashi Akutagawa, Hitomi Funatani, Toshikazu Uchida, Yoshihiro Hotta, Masatake Niwa, Yoshiaki Takaya*

***Reagents vary with products (check procedure)
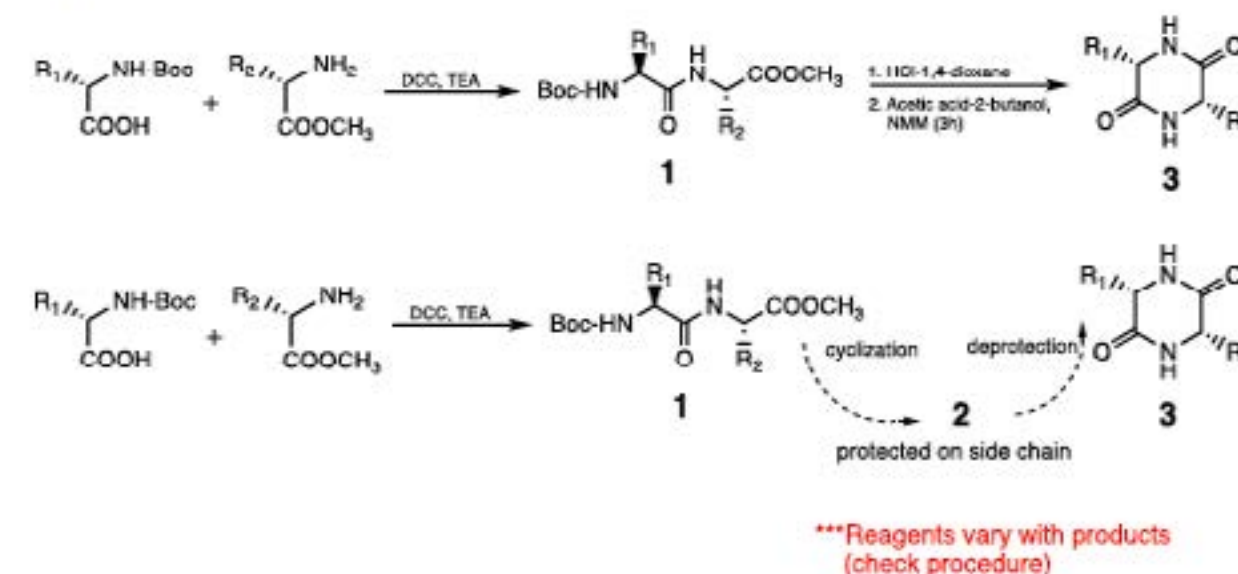
Summary:

20 different cyclic dipeptides containing L-leucine were synthesized using N-protected-L-amino acid and L-amino acid methyl ester as the starting materials. N-protected-L-amino acids and L-amino acid methyl esters were subjected with N,N´-dicyclohexylcarbodiimide (DCC), and triethylamine (TEA) to obtain N-protected-dipeptide methyl esters (1). Dipeptides 1 except for 1P and 1Q were then treated with 4M HCl–1,4-dioxane followed by refluxing in 0.1 M acetic acid–2- butanol with N methylmorphorine (NMM) for 3 hr to provide cyclic dipeptides (3). Cyclo(L-Leu-L-Pro) (3P), cyclo(L-Gln-L-Leu) (3Q), cyclo (L-Cys-L-Leu) (3C), cyclo(L-His-L-Leu) (3H), cyclo(L-Glu-L-Leu) (3E), cyclo(L-Aso-L-Leu) (3D), cyclo(L-Leu-L-Lys) (3K), and cyclo(L-Arg-L-Leu) (3R) were prepared using DCC in the presence of TEA to obtain the N-protected methyl ester but were treated with varying reagents to afford the resulting 8 different diketopiperazines.

Experiment 2: New Diarylmethylpiperazines as potent and selective nonpeptidic δ opioid receptor agonists with increased in vitro metabolic

Niklas Plobeck,* Daniel Delorme, Zhong-Yong Wei, Hua Yang, Fei Zhou, Peter Schwarz, Lars Gawell, Hélène Gagnon, Benjamin Pelcman, Ralf Schmidt, Shi Yi Yue, Christopher Walpole, William Brown, Pierre-Emmanuel Morin, Denis Projean, Julie Ducharme and Edward Roberts
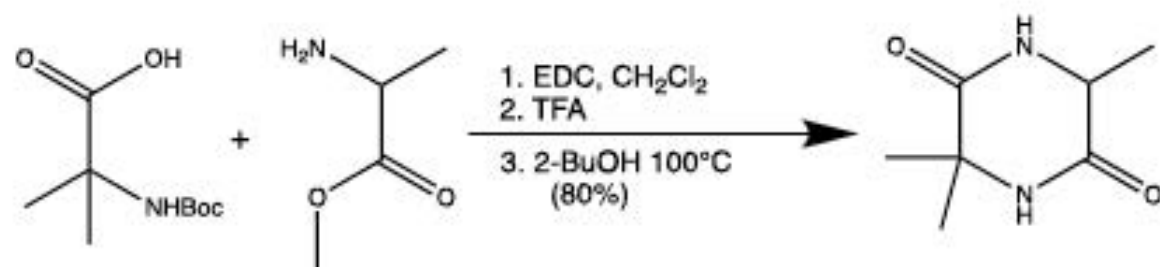
Summary:

   N-Boc-2-aminoisobutyric acid and D, L-alanine methyl ester were used as starting materials. They were coupled using 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC) as the coupling reagent. The dipeptide was deprotected using trifluoroacetic acid followed by heating in 2-butanol at 100°C to afford the 3,3,6-trimethyl-2,5-piperazinedione in 83% yield.

Experiment 3: ESI-MSn study on the fragmentation of protonated cyclicdipeptides

Yan-Chun Guo, Shu-Xia Cao*, Xiang-Kun Zong, Xin-Cheng Liao, and Yu-Fen Zhao

Experiment 3: ESI-MSn study on the fragmentation of protonated cyclicdipeptides

Yan-Chun Guo, Shu-Xia Cao*, Xiang-Kun Zong, Xin-Cheng Liao, and Yu-Fen Zhao

homo-cyclic dipeptides 1-9

hetero-cyclic dipeptides 10-14
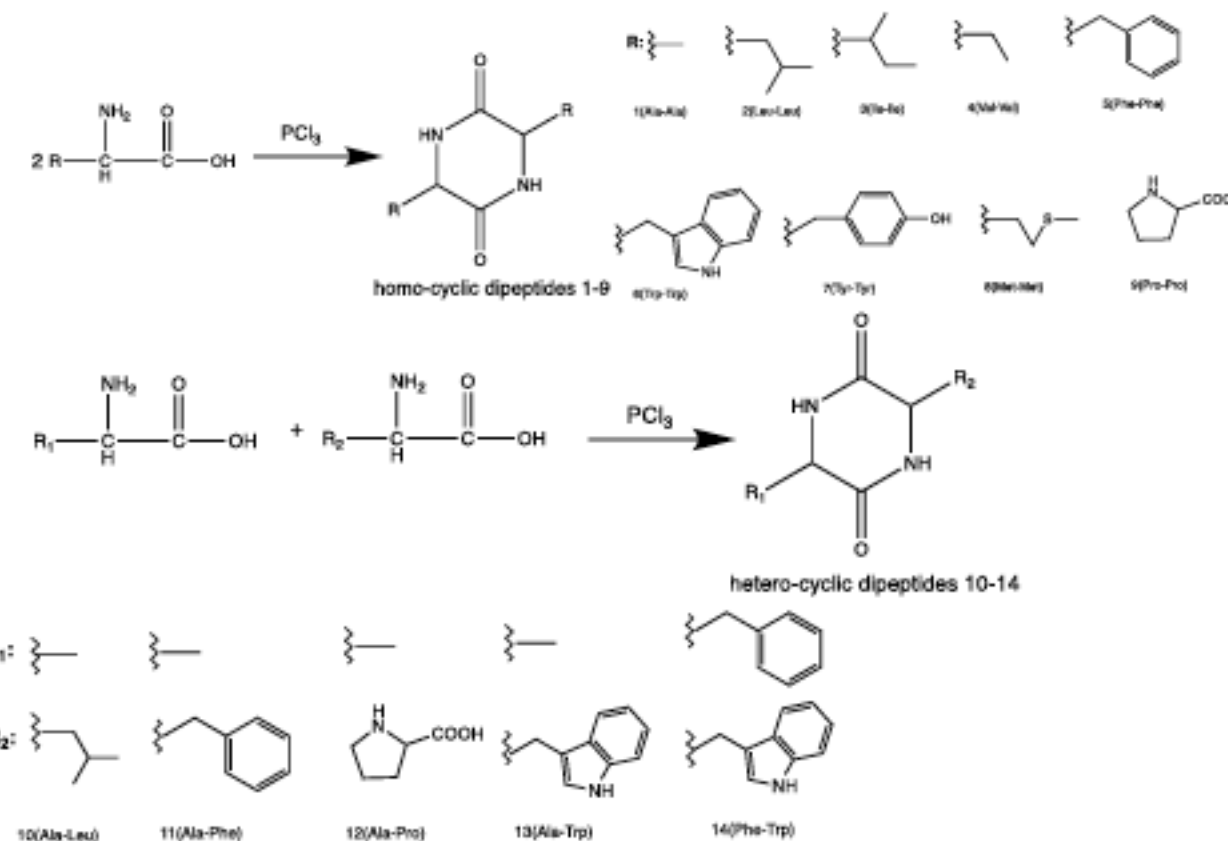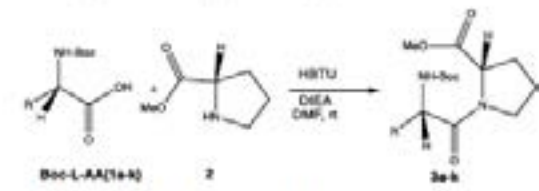
Summary:

   9 different homo-cyclic dipeptides and 4 hetero-cyclic dipeptides were synthesized using L-amino acids and phosphorus trichloride. For homo-cyclic dipeptides, 20mmol of each L-amino acid was dissolved in 30mL THF with 10mmol of PCL3 added after in batches. The mixture was refluxed for 2 hr, where water was added after evaporation, and saturated NaHCO3 was then added to adjust to pH 7-8. The synthesis of heterocyclic dipeptides followed the same procedure except with 10mmol of L-amino acids and was refluxed for 4 hr. Column chromatography was performed as purification and the structure was confirmed by spectroscopy and ESI-MS.

Experiment 4: An efficient green synthesis of proline-based cyclic dipeptides under water-mediated catalyst-free conditions

Habeebullah Thajudeen, Kyungseok Park, Surk-Sik Moon, In Seok Hong Tetrahedron Letters (2010), 51(9), 1303-1305.

Experiment 5: Interfacial supramolecular biomimetic epoxidation catalysed by cyclic dipeptides

Christopher Bérubé, Xavier Barbeau, Sébastien Cardinal, Pierre-Luc Boudreault, Corinne Bouchard, Nicolas Delcey, Patrick Lagüe & Normand Voyer
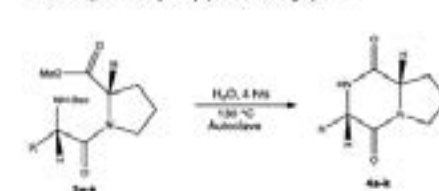
Table 1: Synthesis of linear dipeptides containing a proline

Entry	R(1a-k)	Boc-(L-amino acid)	Yield* (%)
1	HO–C₆H₄–CH₂–	Tyr	95
2	C₆H₅–CH₂–	Phe	92
3	CH₃–	Ala	85
4	(CH₃)₂CH–	Val	86
5	(CH₃)₂CHCH₂–	Leu	90
6	CH₃CH₂CH(CH₃)–	Ile	93
7	H–	Gly	82
8	–CH₂CH₂CH₂–	Pro	88
9	HO–CH₂–	Ser	47
10	H₂N–COCH₂–	Asn	45
11	CH₃CH(OH)–	Thr	94

* Isolated yield after column chromatography

Table 2: Synthesis of cyclic dipeptides containing a proline

Entry	R(3a-k)	Products[a]	Yield[b] (%)
1	HO–C₆H₄–CH₂–	Tyr-Pro	84
2	C₆H₅–CH₂–	Phe-Pro	88[c]
3	CH₃–	Ala-Pro	76
4	(CH₃)₂CH–	Val-Pro	86
5	(CH₃)₂CHCH₂–	Leu-Pro	73
6	CH₃CH₂CH(CH₃)–	Ile-Pro	70
7	H–	Gly-Pro	90
8	–CH₂CH₂CH₂–	Pro-Pro	92
9	HO–CH₂–	Ser-Pro	91
10	H₂N–COCH₂–	Asn-Pro	92
11	CH₃CH(OH)–	Thr-Pro	75

[a] All L-cyclic dipeptides.
[b] Isolated yield after column chromatography.
[c] In this case, 1,4-dioxane (20%, v/v) was added.

Supramolecular Chemistry (2016), DOI: 10.1080/10610278.2016.1236197

Summary:

Thajudeen's group reported 11 examples of green one-pot synthesis of L-proline-based cyclic dipeptides from N-boc-protected dipeptide esters utilizing water as a solvent under catalyst-free conditions. N-boc-protected amino acids were coupled with L-proline methyl ester hydrochloride in DMF solution using N, N-diisopropylethylamine (DIPEA), and 2-(1H-benzotriazol-1-yl)- 1,1,3,3,-tetramethyluronium hexafluorophosphate (HBTU) as a coupling reagent at room temperature to afford the linear dipeptides. N-boc deprotection and cyclization were obtained in a single step by employing water under autoclave conditions at 130°C for 4 hr to produce the resulting cyclic dipeptides. Column chromatography was used to purify the linear dipeptides and cyclic dipeptides.

Summary:

Bérubé and coworkers reported a library of cis- and trans-cyclic dipeptides synthesis involving the condensation of two N-boc amino acids using oxime resin and standard peptide solid-phase synthetic strategies. The first amino acid was coupled with oxime resin in the presence of diisopropylcarbodiimide (DIC) as a coupling reagent for 3 hrs. A 1:1 trifluoroacetic acid (TFA)/dichloromethane mixture was then employed to cleave the N-Boc protecting group, followed by the activation of the second amino acid using hydroxybenzotriazole (HOBt) and (2-(6-Chloro-1H-benzotriazole-1-yl)-1,1,3,3-tetramethylaminium hexafluorophosphate(HBTU). The linear dipeptide was cyclized and removed from the resin at the same time using 2.5 equiv diisopropylethylamine (DIEA) and 5 equiv acetic acid in DCM after deprotection of the N-boc group. A total of 58 CDPs were prepared and verified by 1H NMR, 13C NMR, and mass spectrometry analysis.

Experiment 6: In vitro condensation of amino acids in aqueous media: A synthesis driven by catalytic carbon monoxide oxidation

Joseph E. Remias, Christine Elia, Laurie E. Grove, Ayusman Sen *

Inorganica Chimica Acta (2006), 359, 2956–2965

Experiment 7: Studies on the synthesis and some reactions of (S)-proline hydrazides

Grzegorz Mloston , Adam M. Pieczonka , Aneta Wr.blewska , Anthony Linden , Heinz Heimgartner

Tetrahedron: Asymmetry (2012), 23, 795–801

Scheme 3.

Summary:

Sen's group reported a new mechanism for amino acid condensation in aqueous media involving palladium-catalyzed Pd(0)/Pd(II) redox cycle and carbon monoxide as oxidant. The catalytic carbon monoxide oxidation to carbon dioxide triggered a thermodynamically uphill condensation of the reaction. However, this reaction could only occur with several amino acids such as glycine, alanine, beta-alanine, and 5-aminopentanoic acid and special attention must be paid when dealing with the gas pressure.

Summary:

Cyclo(pro-pro) was synthesized from two different procedures. The first procedure used 10mmol of (S)-proline methyl ester in 5ml methanol as the starting material. It was then subjected to 20mmol of NH2NH2 distilled over KOH pellets and stirred at room temperature for 16hr. The second method employed 10mmol of (S)-proline and was refluxed with 2.4mL of thionyl chloride for 30min, followed by the addition of 1.18mL of NH2NH2 distilled over KOH pellets once cooled down to room temperature. It was then refluxed for another hour followed by extraction to confirm the purity. The percent yield of cyclo (pro-pro) from procedure 1 was better than the second with 63% and 27% respectively, while the melting points were not that different.

Experiment 8: Enantiomerically pure piperazines via NaBH4/I2 reduction of cyclic amides

Vagala Harish, Mariappan Periasamy

Tetrahedron: Asymmetry (2017), 28, 175–180

Scheme 1

Experiment 9: New and Unexpected Insights into the Modulation of LuxR-Type Quorum Sensing by Cyclic Dipeptides

Jennifer Campbell, Qi Lin, Grant D. Geske, and Helen E. Blackwell Heimgartner

American Chemical Society (2009), Vol.4, No.12, 1051–1059
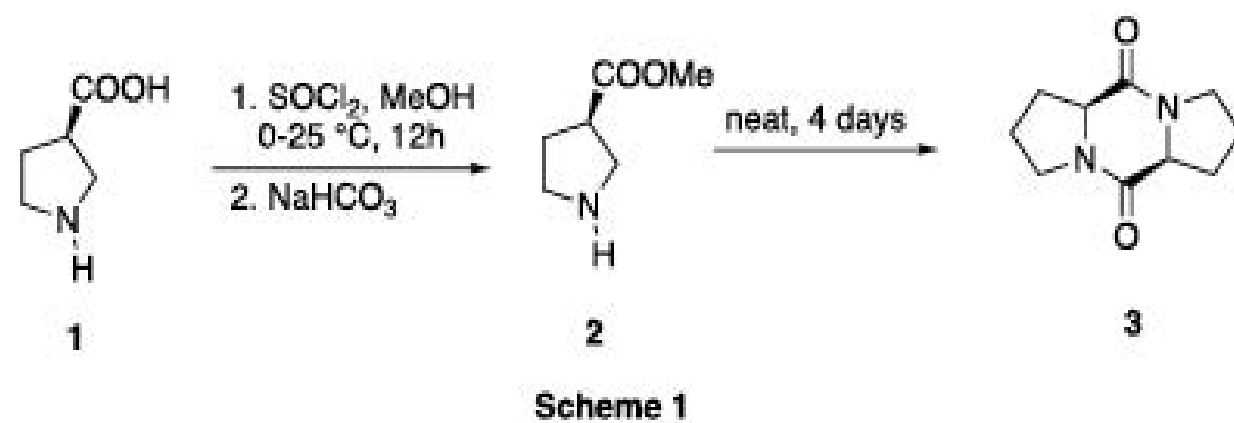
Summary:

Cyclo(pro-pro) was synthesized using enantiomerically pure L-proline as the starting material. 10mmol of L-proline in 50mL methanol was treated with 15mmol thionyl chloride dropwise at 0°C-25°C. After returning to room temperature, the mixture was stirred for 12 hr followed by evaporation of the solvent under reduced pressure to afford hydrochloride salt of L-proline methyl ester, which was then dissolved in 100mL CH2Cl2 and neutralized with NaHCO3 to obtain L-proline methyl ester. The L-proline methyl ester was stirred for 4 days at room temperature (neat). The cyclic dipeptide was achieved after recrystallization from ethyl acetate.

Summary:

A library of diketopiperazines was synthesized and studied by Blackwell's group starting from L- or D-proline methyl ester and N-boc-protected amino acids. They were coupled using 1 equiv of EDC.HCl as a coupling reagent and 1 equiv of Et3N in CH2Cl2 at 4°C for 16 hr to afford dipeptide X. X was then treated with 5 equiv acetyl chloride in methanol at 0°C and stirred for 3 hr as a deprotection step. The resulting deprotected dipeptide underwent cyclization using 2 equiv piperazine in DMF and was stirred at 25°C for 1hr to achieve the cyclic dipeptide. Flash silica gel chromatography was performed to purify the product giving those 29 cyclic dipeptides between 15-86% yield and >97% purities with 95:5 dr.

Experiment 10: Synthesis and antitumor activity in vitro of glioperazine C and its derivatives

Pengfei Wang, Longfei Miao, Hongye Zhao, Dan Wu, Luyao Wang, Yuou Teng, Hua Sun, and Peng Yu

Journal of Chemical and Pharmaceutical Research, 2015, 7(1):85-90
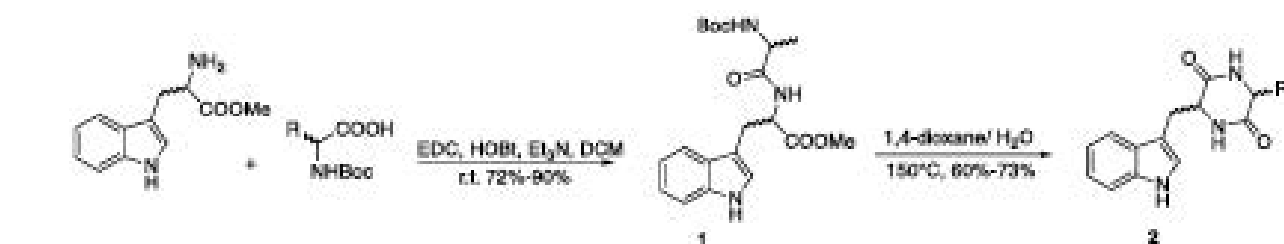
Experiment 11: Spontaneous self-assembly of aromatic cyclic dipeptide into fibre bundles with high thermal stability and propensity for gelation

T. Govindaraju

Supramolecular Chemistry Vol. 23, No. 11, November 2011, 759–767

Summary:

    12 examples of D/L-tryptophan based cyclic dipeptides were synthesized using D/Ltryptophan methyl ester and N-boc amino acid as the starting material. They were coupled using 6.0mmol of EDC, 6.0mmol HOBt, and 6.0mmol of Et3N and stirred at room temperature for 3-5 hr providing 72-90% yields after column chromatography. The N-boc-dipeptide methyl ester was then treated with 20mL of 1,4-dioxane/H2O and was stirred for 10-16hr at 150°C to obtain the resulting cyclic dipeptide, which after washing with water, ethanol, and DCM providing 63-82% overall yields.

Summary:

    The literature article illustrates the synthesis of (LL)- and (DD)-isomers of cyclo (Phe-Phe) through the condensation of Fmoc-(L)-Phe-OH with H-(L)-Phe-OMe using standard peptide coupling reagents and conditions of EDC, HOBt, DIPEA, DCM, RT, 5h. This condensation produces the protected dipeptide Fmoc-Phe-Phe-OMe which is then subjected to 10% piperidine in dichloromethane to undergo Fmoc-deprotection. This process results the synthesis of the cyclic dipeptide

Experiment 12: Structure–Activity Relationships of cyclo(L-Tyrosyl-L-tyrosine) Derivatives Binding to Mycobacterium tuberculosis CYP121: Iodinated Analogues Promote Shift to High-Spin Adduct

Sunnia Rajput, Kirsty J. McLean, Harshwardhan Poddar, Irwin R. Selvam, Gayathri Nagalingam, James A. Triccas,§ Colin W. Levy, Andrew W. Munro, and Craig A. Huttonand Peng Yu

Experiment 13: Efficient Microwave Assisted Synthesis of 2,5-Diketopiperazines in Aqueous Media

Lemuel Pérez-Picaso 1 , Jaime Escalante 1 , Horacio F. Olivo 2 and María Yolanda Rios

J. Med. Chem. (2019), 62, 9792–9805

Molecules (2009), 14, 2836-2849; doi:10.3390/molecules14082836
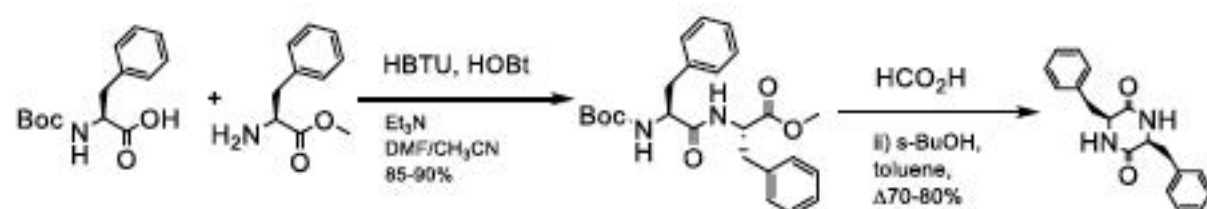
Summary:

    The N-Boc amino acid was coupled with a-amino methyl ester using HBTU and HOBt in dimethylformamide/acetonitrile to make a dipeptide. The dipeptide was treated with excess formic acid to remove the Boc group, which was then heated in a mixture of toluene and sec butanol to cyclize into the diketopiperazine.
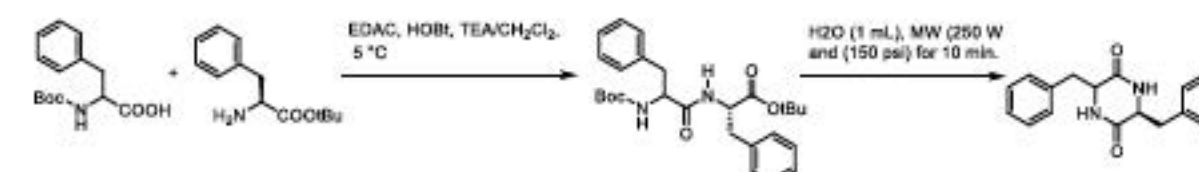
Summary:

    The literature paper studied the cyclization of the 2,5-diketopiperazine with the assistance of microwave heating. The Boc-protected phenylalanine was coupled with phenylalanine tert-butyl ester using EDAC, HOBt, TEA/CH2CL2 in 5°C to produce Boc-protected dipeptide which is then cyclized into the 2,5-(Phe-Phe) diketopiperazine using microwave irradiation for 10 minutes. The percent yield of the cyclization of 2,5-(Phe-Phe) diketopiperazine studied is 96%.

Experiment 14: A Convenient Approach to the Enantiopure (1 S ,2S 4s , 5 S) - and (1R ,2S ,4R ,5S)-2,5-Bis(phenylmethyl)-194-diazabicyclo[2.2,2]- octane

Qiu, L.-H & Shen, Z.-X & Chen, W.-H & Zhang, Y. & Zhang, Y.-W.

Experiment 15: Radical-Scavenging Antioxidant Cyclic Dipeptides and Silk Fibroin Biomaterials

Shivaprasad Manchineella, Chandrashekhar Voshavar, and Thimmaiah Govindaraju
Manchineella, S., Voshavar, C., & Govindaraju, T.
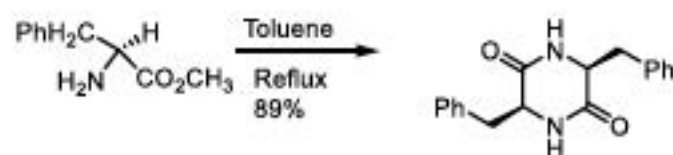
Summary:

        The phenylalanine methyl ester is obtained from the hydrochloride by dehydrochlorination with a saturated solution of sodium bicarbonate. It was then refluxed in toluene, which resulted in the appearance of a white precipitate. The mixture was heated for 5 hours and then cooled to form crystals that were washed twice with ether. The final product was (3S, 6S)-bis (phenylmethyl) piperazine-2,5-dione.
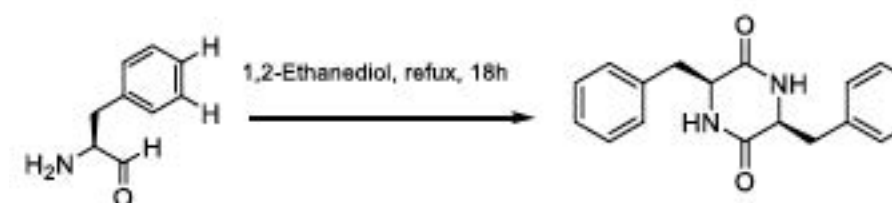
Summary:

        The cyclo(L-Phe-L-Phe) is a result of the condensation of the amino acid in 1,2-Ethanediol under reflux of 18h. This experiment has a percent yield of 72%.

Cost Analysis

Reagents	Common name	Price	Price2
DCC	N,N'-Dicyclohexylcarbodiimide	$57.60/ 100g	$146/500g
TEA / Et3N	Triethylamine	$26.30/ 100mL	$35.60/1L
HCl-1,4-dioxane	Hydrogen chloride-1,4-dioxane	$79.70/100 mL	$343/800 mL
CH3COOH	Acetic acid	$29.70/100 mL	$65.10/1L
NMM	N-methylmorpholine	$25.60/500 mL	$91.40/1L
C6H6	Benzene	$49.30/100 mL	$96.30/1L
Pd/C	Palladium/carbon	$107/10g	$402/50g
CH3OH	Methanol	$35/100m L	$67.10/1L
CF3COOH/ TFA	Trifluoroacetic acid	$86.70/100 mL	$492/1L
CH2Cl2	Dichloromethane (DCM)	$47.60/100 mL	$67.10/1L
CHCl3	Chloroform	$43.40/100 mL	$84.90/1L
CH3COCH3	Acetone	$50.80/500 mL	$68.20/1L
HCOOH	Formic acid	$45.20/100 mL	$73.40/500 mL
NaHCO3	Sodium Bicarbonate	$45.60/500 g	$71.90/1kg
Na2SO4	Sodium sulfate	$63.40/500 g	$199/2.5kg
CH3CHOCHCH2 CH3/2-butanol	2-Butanol	$62.30/1L	
EDC.HCl	1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride	$121/10g	$826/100g
LAH	Lithium aluminium hydride	$159/100g	$455/500g
THF	Tetrahydrofuran	$62.70/100 mL	$121/1L, $184/2L
Boc2O	Di-tert-butyl dicarbonate	$43/10g	$218/100g

Reagents	Common name	Price	Price2
CH2COOH C(OH)COOH-CH2COOH	Citric acid	$40.30/100 g	$61.90/500 g
PCl3	Phosphorus trichloride	$59.70/250 g	$135/1kg
KOH pellets		$43.20/500 g	$70.80/1kg
CH3COOC2H5/ EtOAc	Ethyl acetate	$70.30/500 mL	$81.30/1L
HBTU	Hexafluorophosphate Benzotriazole Tetramethyl Uronium	$82.50/5g	$301/25g
DIPEA	N,N-Diisopropylethylamine	$44/100m L	$135/500 mL
DMF	N, N-Dimethylformamide	$61.10/100 mL	$109/1L
DIC	N,N'-Diisopropylcarbodiimide	$76/25g	$199/100g
HOBt	Hydroxybenzotriazole	$70.30/25g	$195/100g
DMAP	4-Dimethylaminopyridine	$52.40/25 g	$133/100g
NH2NH2	Hydrazine Anhydrous	$114/50g	$198/100g
SOCl2	Thionyl Chloride	$57.10/100 mL	$165/1L
Piperidine	Piperidine	$36/100m L	$138/1L
CH3COCl/ AcCl	Acetyl chloride	$35.80/100 mL	$99.30/L
	Petroleum ether	$149/1L	
	Oxime resin	$82.30/1g	$347/5g
NH2NH2.H2O	Hydrazine hydrate solution	$88.30/250 mL	$180/1L
5% pd/c		$28.30/1g	$81.40/10g
L-alanine methyl ester hydrochloride		$90.20/25g	$252/100g
L-proline methyl ester hydrochloride		$77.20/5g	$246/25g
L-alanine		$73.50/100 g	
L-proline		$82.20/100 g	

Reagents	Common name	Price	Price2
L Leucine		$75.30/100 g	
L-Valine		$77.90/100 g	
L-Methionine		$69.80/100 g	
L-Isoleucine		$152/100g	
L-Tryptophan		$116/100g	
L Tyrosine		$137/100g	
L-Phenylalanine		$86.10/100 g	
L-Serine		$95.70/100 g	
L-Threonine		$132/100g	
	Toluene	$72.17/11 lbs	
	Acetonitrile		$38.23/1L
OHCH2CH2OH	1,2-ethanediol	$49.90/100 mL	$111/1L
Phenylalanine tert-butyl ester		$38/1g	$74/5g

Analysis Discussion

• Experiment 1 takes 8 hours for the reaction that doesn't require protecting group on the side chain. This experiment takes too long to complete for students' lab setting. Moreover, the procedures of forming the linear dipeptides and cyclic dipeptides varies depending on different peptides, which might be a bit complicated to create as a lab manual.

• The total reaction time for experiment 2 is around 17 hours. The reaction requires it to be left in the freezer for 4 days as well. On top of time-consuming, this experiment is also expensive as it uses 4.8g EDC.HCl. As indicated above, EDC.HCl costs $121/10g. This experiment uses substituted amino acids. Thus, modifications need to be done to obtain the desired cyclic dipeptide.

• Experiment 3 is ideal for student's lab as the total reaction time is around 3-4hours and is cost-efficient. The primary reagent used is PCl3 which is $59.70/250g. This experiment is fascinating because it can synthesize different types of cyclic dipeptides in just one step.

• Experiment 4 is not ideal for student's lab because the total reaction time takes around 1 night and 5 hours. The reagents used are also expensive, where HBTU alone costs $22.6 per experiment.

• Experiment 5 is not ideal for student's lab because the reagents are so expensive. The total reaction time is also too long, which is around 31 hours to complete. Solid-phase synthesis has become popular using oxime resin to create cyclic dipeptides. However, this is only ideal for industrial purposes and not for student's labs.

• Experiment 6 is not ideal for student's lab because it requires a lot of caution as it uses gas mixture under pressure which may be dangerous for the students.

• Procedure B of experiment 7 takes around 2.5-3 hours. The reaction time is ideal for the student's lab. This experiment only looks at the synthesis of cyclic(pro-pro) using NH2NH2 as the reagent. However, there hasn't been a lot of studies about the synthesis of cyclic dipeptide using NH2NH2.

• Experiment 8 focuses exclusively on the synthesis of cyclo(pro-pro) using SOCl2 and NaHCO3 as the reagents. Unfortunately, this experiment is not ideal for student's lab because the reaction takes around 4 days and 13 hours to complete.

• The total reaction time for experiment 9 is around 20 hours. This experiment uses EDC reagent for the peptide coupling at 4°C followed by deprotection and then cyclization using piperidine. The total reaction time is not ideal for the student's lab setting; however, it is possible that the reaction can be completed faster with some modifications. This experiment is interesting as it follows the proposed synthesis.

• Experiment 10 may not be ideal for student's lab based on the total reaction as it takes between 13-21 hours to complete. The use of EDC and HOBT as the reagents to form linear dipeptides, follow by 1,4-dioxane/H2O to create cyclic dipeptides make this reaction interesting to explore. However, this experiment mainly focuses on the synthesis of cyclic dipeptides that contain tryptophan or threonine amino acids.

• Experiment 11 may not be ideal because it is not time efficient based on the small timeframe there is for a chemistry lab at Cal Poly Pomona, which is 3 hours. This experiment takes about 12 hours to complete.

• Experiment 12 is not ideal because it tests the binding to the bacteria Mycobacterium tuberculosis which is not ideal in a chemistry laboratory for undergraduate students. It may be a safety concern handling such bacteria.

• Experiment 13 is not too ideal in an organic chemistry laboratory class because microwave irradiation is required to make the cyclic dipeptides. Since groups of students are to work together in pairs and there is only 1 microwave in the chemistry department, it would not be time efficient to wait until the microwave is free to do the experiment. Other than that, it would be ideal as lab module because of the 96% percent yield in the cyclization of diketopiperazine.

• Experiment 14 requires the heating of the reaction for five hours which would not be an ideal timeframe for the lab procedure. Additionally, the crystals would have to be washed twice and dried.

• Experiment 15 would not be the ideal laboratory module because it takes 18 hours just for the heating at reflux in preparing the cyclo(L-Phe-L-Phe).

Shortlist Reactions

Based on the analysis that has been done and explored, EDC coupling and PCl3 reaction are the two shortlist reactions that will be used to pilot our cyclic dipeptides experiments. This is due to the fact that peptide coupling using EDC.HCl has become so popular among today's scientists. Despite being a little expensive, we would like to see how that experiment turns out to be. A one- step PCl3 reaction is another easy and interesting reaction to perform as it provides a broad range of peptides with low cost and less time-consuming. A variety of protecting groups necessary to protect amino acids used in EDC coupling reaction will be evaluated and studied. The N-Boc protecting group will be evaluated first as it was efficiently employed in the currently studied experiments.

Mechanism of EDC Peptide coupling

Peptide coupling using EDC Mechanism

Linear Dipeptide

Urea byproduct

Mechanism of PCl3 reaction

PCl₃ and peptide reaction mechanism

Reaction Intermediate

Cyclic dipeptide
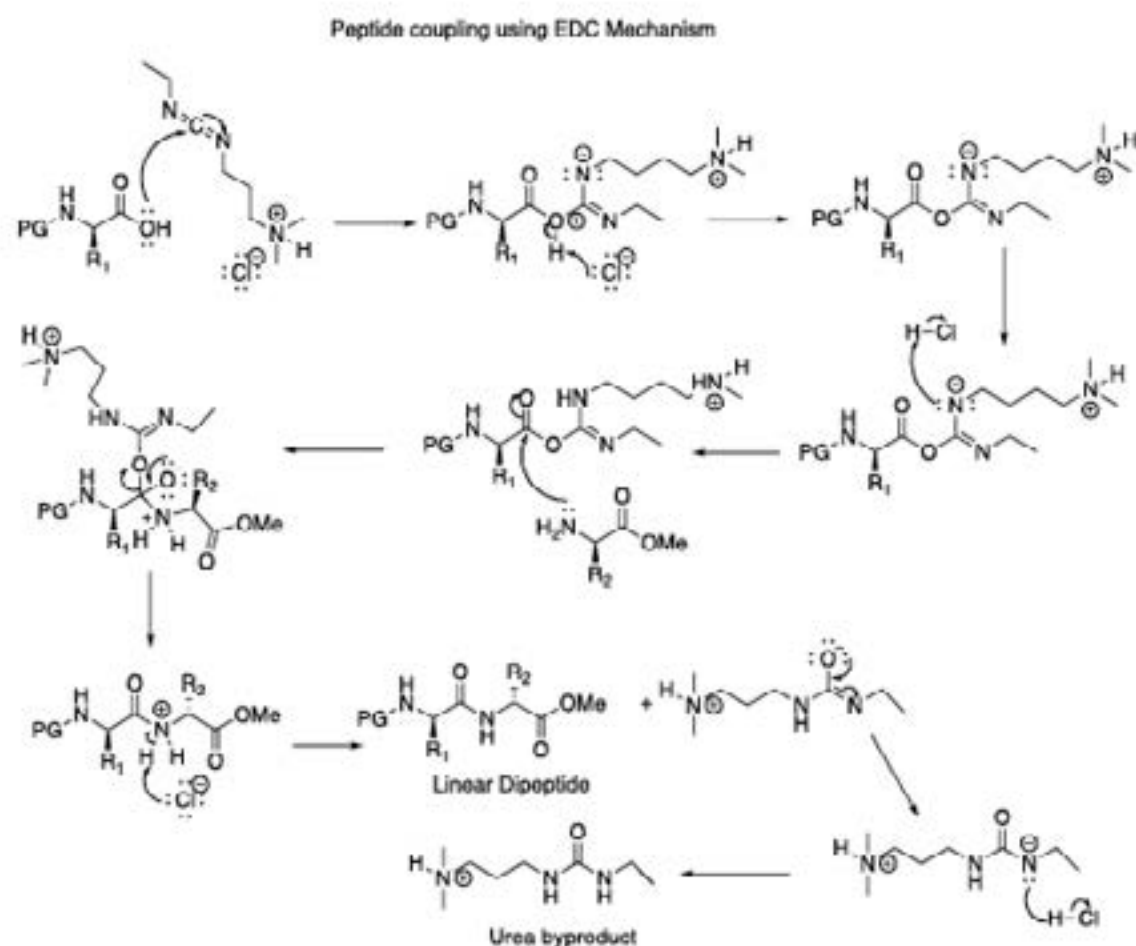
Conclusion and Future Experiments

Once it is safe to get back to the lab, the two shortlist reactions will be performed to finalize which one is most suitable to incorporate into the Organic Chemistry lab for students. Since those two reactions provide a varied range of amino acids to synthesize as cyclic dipeptides, it is possible that the future experiments may broaden beyond the cyclic dipeptides scope that is currently studied. This means that this lab can be formatted as an unknown lab where students can apply other previous knowledge and skills they have learned in Organic Chemistry, such as 1H-NMR and 13C-NMR, to figure out their unknown.

[1] J. Med. Chem. (2019), 62, 21, 9792–9805. https://doi-org.proxy.library.cpp.edu/10.1021/acs.jmedchem.9b01199

[2] Lemuel Pérez-Picaso 1, Jaime Escalante 1 , Horacio F. Olivo 2 and María Yolanda Rios. Molecules (2009), 14, 2836-2849; doi:10.3390/molecules14082836

[3] PAC, 1972, 31, 577. (Manual of Symbols and Terminology for Physicochemical Quantities and Units, Appendix II: Definitions, Terminology and Symbols in Colloid and Surface Chemistry) on page 607

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Using NMR Spectroscopy for the Analysis and Quantification of Butanol and Butyric Acid

Abstract

As the Earth's climate increases due to carbon emissions, greenhouse gases and fossil fuels, research has been dedicated to finding alternatives for fuels. Ethanol has previously shown promise as a prominent biofuel as energy source for cars in gasoline.[1] However, n-butanol has been making headway as butanol is much different from ethanol in terms of physiochemical properties. Butanol has a higher boiling point, not as volatile, and has higher viscosity. These properties are advantageous as butanol can cause less ignition issues in fuel and is safer for transport.[1,2] This research dives deeper into an ethical and sustainable source of butanol production, from the bacteria Clostridium beijerinckii. Sources to produce other well-known biofuels such as ethanol and methanol, rely heavily on raw materials.[2] However, butanol is produced through the fermentation process also known as acetone-butanol-ethanol (ABE) fermentation in specific bacteria.[2] Research interest in ABE fermentation has increased significantly, this has been duly in part of increasing prices of oil in the past few years.[3]

This research sought to determine a method to analyze and quantify the organic materials of butanol and butyric acid. As typical one-dimensional nuclear magnetic resonance (NMR) could not be utilized due to overlapping spectrums of the two structures. To combat this, the two-dimensional experiment TOCSY was used, as it has shown notable quantification where one-dimensional NMR cannot be used.[4]

Findings of this research concluded that two-dimensional NMR proved to be an adequate method in quantifying organic materials such as butanol and butyric acid. This method is speculated to have a limit of detection (LOD) around 4 mM, however further research needs to be conducted.

Objective

This study will attempt to find a sustainable source of butanol production as a biofuel and a novel quantification method for the organic material from the bacteria Clostridium beijerinckii through two-dimensional NMR.

Introduction

To reduce the dependence on petroleum and other fossil fuels, the demand for biofuel is rapidly increasing. Research to find an ethical and sustainable source of biofuel has been progressively popular as fossil fuels has been the foundation for greenhouse gases emissions as a primary contributor to climate change.[2,3] Ethanol, another biofuel has been steadily used as a gasoline additive, however butanol has shown to be more beneficial as an energy source. Butanol has a higher energy content per molecule, limited miscibility with water, low vapor pressure and lower corrosivity than ethanol as noted in Table 1.[2,4,5] Furthermore, butanol can be easily combined into an existing internal combustion engine.[4,6] Butanol is commonly made from crops such as starch, wheat, corn, etc. thus the food industry has increased prices to keep up with demand. [2,7] As a result, the need for a cost-effective and ethical source of raw material to produce butanol is heavily sought after.

The production of butanol can be generated through a metabolic process name acetone-butanol-ethanol (ABE) fermentation.8 The Clostridium species has been noted to undergo this fermentation process with C. beijerinckii showing the most butanol production.[2] However, studies have noted that some Clostridium strains to experience the metabolic process of acetone-butanol-isopropanol (ABIp) or isopropanol-butanol-ethanol (IBE) production.[9,10] Optimizing the production of butanol produced from biological sources, such as bacteria, is complex because the intricacy of the biological system which makes it difficult to quantify the solvents and acids produced. In this study, the bacteria Clostridium beijerinckii is studied as it has shown to undergo ABE and ABIp fermentation. This fermentation process allows the bacteria to convert biomass into biofuel.[11] ABE fermentation is broken into two major phases: acidogenic and solventogenic phase.[4] In the acidogenic phase, acids are produced together with cell growth. During this stage, cells reproduce themselves and then undergo a morphological change which leads to the next phase. Solventogenic phase, acids are thus converted into solvents: acetone, butanol, and ethanol.[2,4,12,13] Figure 1 displays the metabolic pathway alongside the catalysts for the processes.

Nuclear magnetic resonance (NMR) is a versatile spectroscopic method used in several applications including science and medicine.[14] Benefits include the rapid spectral acquisition and NMR resonances which provide a direct measure of metabolite concentration based on a single internal standard.[15] However typical 1H NMR proves to be an insufficient method of quantifying organic materials due to the overlap of the peaks. Whereas 2D NMR allows for further characterization that is unavailable with 1D NMR.[14,16,17] In this study we have implemented a fast two-dimensional experiment for the simultaneous quantification of metabolites produced from anaerobic fermentation of the bacteria Clostridium beijerinkii named total correlation spectroscopy (TOCSY). TOCSY is a homonuclear and shift-correlated 2D NMR test where coherence transfer occurs via scalar couplings. Cross-peaks also contain both passive and active couplings in-phase.18 The use of a two dimensions allows for better dispersed signals however its accuracy is less than the typical 1D NMR.[16,19]

Investigating two-dimensional NMR methods for quantifying organic materials will allow for butanol production to become more sustainable and efficient.

Table 1: Comparison of Physical Properties of Gasoline and Various Biofuels.[2,4,8] Butanol and gasoline have more similar physical properties than gasoline and ethanol.

Fuel	Energy Density (MJ/L)	Heat of Vaporization (MJ/kg)	Vapor Pressure (kPa at 20 °C)	Boiling Point (°C)	Solubility in 100 g of water
Gasoline	32.0	0.36	-57.1 to -56.6	27 – 221	Immiscible
Butanol	29.2	0.43	0.5	117 – 118	Immiscible
Ethanol	19.6	0.92	5.95	78	Miscible
Methanol	16.0	1.20	12.8	64.7	Miscible

Figure 1: Metabolic pathway for ABE fermentation in the *Clostridium* bacteria. Notably, butyrate is a precursor to produce butanol, the species of interest.[2,4,12,13,20]
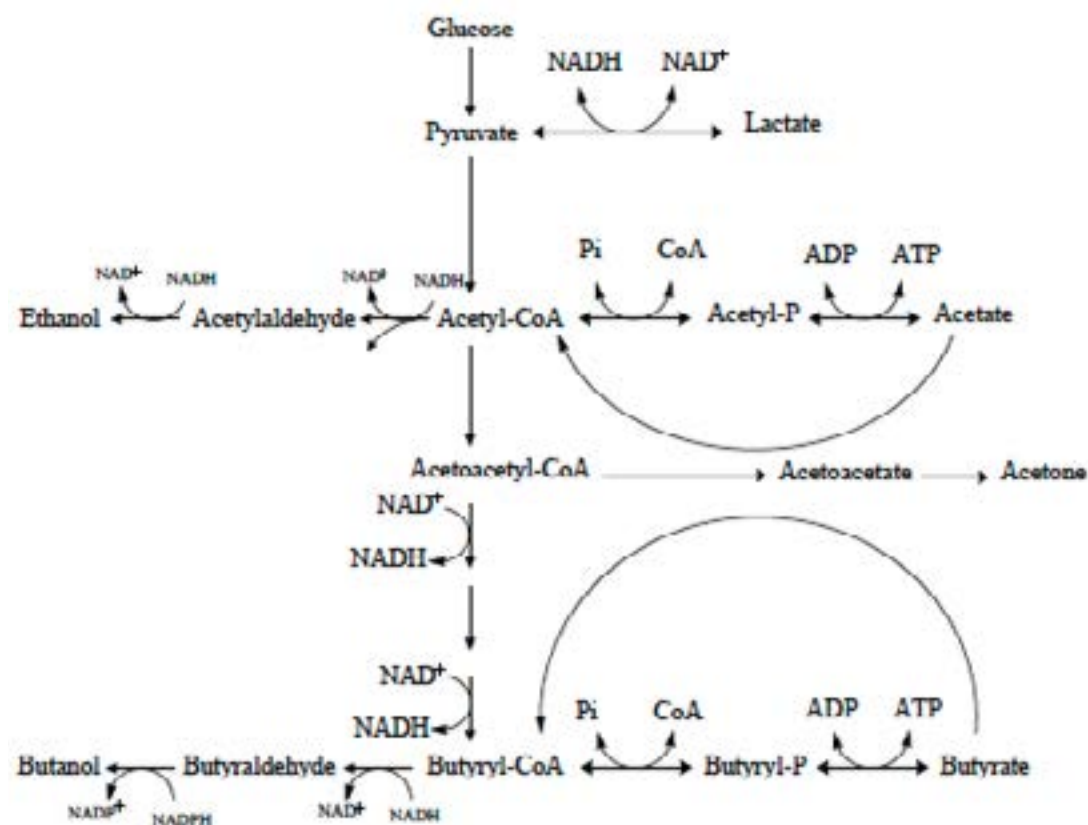
Methods & Materials

The instrumentation used was a 400 MHZ Varian NMR (Agilent Technologies) with software VNMRi 4.2. Data analysis was completed utilizing MestReNova version 14.1.0-24037. 3-(Trimetylsilyl)-1-propanesulfonic acid-d6 was purchased from Sigma-Aldrich, Deuterium Oxide (D2O) was purchased from Acros Organics. 1-Butanol, Butyrate, and ultra-pure water were purchased from Fisher Chemicals. The supernatant samples of Clostridium beijerinckii were isolated from Dr. Wei-Jen Lin's laboratory from the Biology department at California State Polytechnic University, Pomona.

The calibration curve consisted of five varying concentrations: 2, 4, 6, 8 and 10 mM. Each sample contained their respective concentrations of butanol and butyrate, D2O, ultra-pure water, and 3-(Trimethylsilyl)-1-propanesulfonic acid-d6 sodium salt (DSS). D2O was used in NMR to prevent high absorption of water, to prevent a big peak in the spectra. DSS serves as the internal standard as the NMR is not very reproducible. As the calibration curve was created, the five unknown strains of the bacteria's supernatant were tested: L34A, L34B, L31C, L32C and L35A. All were tested utilizing the 1H and TOCSY test.

The NMR method was set up with the following parameters: one Wet 1D, one Wet 1D TOCSY, and a zTOCSY1D. The Wet 1D exam was for simply one sample in the set, with eight scans, suppress the tallest peak, and analyze frequencies at: 0.8 ppm, 1.2 ppm, 1.5 ppm, and 2.2 ppm. The tallest peak is suppressed due to the signal produced by the ultra-pure water, and the frequencies chosen to correspond to the analytes predicted to produce a signal around. The Wet 1D TOCSY was created with the same parameters as Wet 1D. Finally the zTOCSY1D was established with 32 scans, a spinlock of 80 ms, and 50 mHz for all selected frequencies.

Results and Discussion

Nuclear magnetic resonance spectroscopy is often utilized due to its nondestructive tendency, and provides the structural, electronic, and physicochemical properties of molecules.21 Furthermore, NMR offers the ability to determine concentrations of multiple analytes with minimal sample adjustment. The two analytes 1-butanol and butyric acid have interfering peaks in a typical 1H NMR at multiple frequencies, with 1-butanol's peaks at 0.94, 1.39, 2.24, and 3.63 ppm. While butyric acid's signals are around 0.98, 1.68, 2.33, 11.51. Figure 2 demonstrates the overlapping spectra of both analytes, specifically at the 0.90 – 0.95 ppm range. With this, the peaks at 3.6 ppm for 1-butanol and 2.3 ppm for butyric acid were chosen to be integrated for the following equation:

$$[Analyte] = \frac{[Standard] \cdot Area_{analyte} \cdot Number\ of\ Protons_{standard}}{Area_{standard} \cdot Number\ of\ Protons_{analyte}}$$

As the signal produced from the analyte is directly proportional to its concentration.

Figure 2: The ¹H spectra of the 10 mM standard with overlapping peaks of the species of interest.

This overlap renders the peak unable to be quantified or integrated.

Figure 3: ¹H spectra of the negative control group.
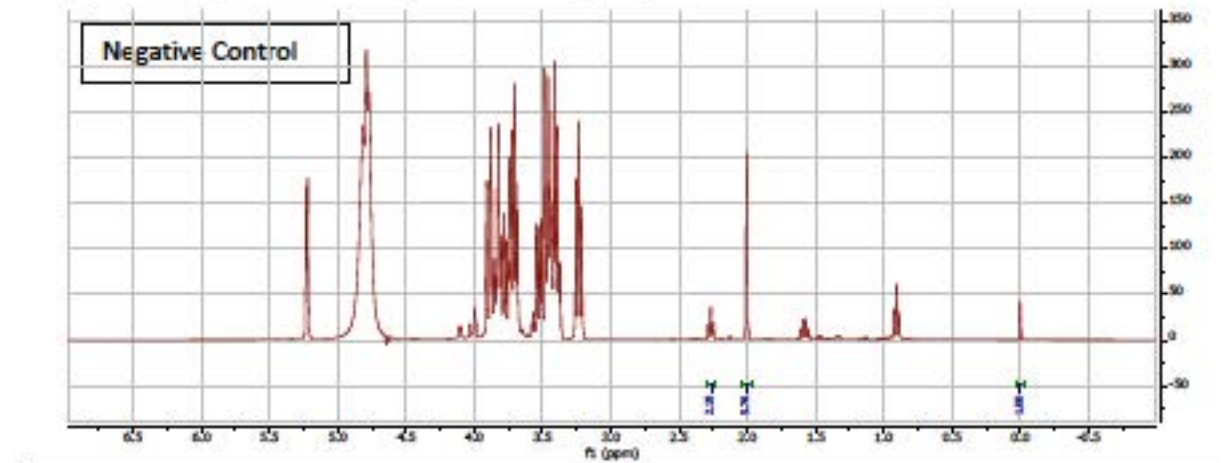
Figure 4: ¹H spectra of Clostridium *Beijerinkii*'s strain L31B.

   The NMR tubes were prepared and tested with 1H and the TOCSY, with frequencies at 0.8 ppm, 1.2 ppm, 1.5 ppm, and 2.2 ppm for the selective TOCSY. However, the 2.2 ppm frequency was undetected, signifying that a different frequency should be chosen.

   Figures 3 and 4 display the differences between the negative control group and strain L31B of the 1H one-dimensional spectra. Peaks are expected for isopropanol and ethanol around 1.1 – 1.2 ppm. Isopropanol may also be produced under the fermentation process of Acetone-Butanol- Isopropanol (ABIp) fermentation. Butanol peaks around 1.3 – 1.6 ppm and 0.9 ppm, which is confirmed in Figure 4. To confirm that ABE fermentation is undergone in each strain, the peak of acetone must be detected around 2.2 ppm. L31B, L34A, L34B, L31C, L32C and L35A were confirmed of the presence of butanol and butyric acid through ABI fermentation.

Conclusion

   The use of NMR spectroscopy provided the ability to analyze complex biological samples, in particular 2-D test, TOCSY. The six strains of Clostridium beijerinkii: L31B, L34A, L34B, L31C, L32C and L35A were able to undergo ABIp fermentation.

   From the calibration curves, it was analyzed that the limit of detection was around 4 mM, and limit of quantification was around 6 mM of butanol and butyric acid.

   Due to COVID-19, data collection has been sparse but will be expected to resume summer 2021. More research needs to be done to reach a conclusion of reproducibility, and optimization of the method.

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Ferrer   **Community Engagement Analysis Enhancing Civil**
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Dr. D. Karim
Dr. S. Johnson
Abstract

        The City of Santa Ana has a unique, city layout consisting of 60 neighborhood district that are mostly active, which sets a strong foundation for the city government to conduct strong community engagement. The City of Santa Ana provided public record of their Sunshine Ordinance Meeting and Project Design documents to create a strong basis for this research. In addition, there are a few community organizations, such as Orange County Communities Organized for Responsible Development (OCCORD) and Santa Ana Collaborative for Responsible Development (SACReD), that provided a different perspective on the level of Civil Participation that the city government is currently conducting. Further insight was given through interviews via Zoom with the City of Santa Ana's Project Team (Ali Pezeshkpour and Margarita Macedonio) and Toll Brother's Apartment Company developer John Hyde. The following research consists of addressing the following questions: Why is community engagement important and why should it be a greater part of Urban Planning? Is there sufficient community engagement in the City of Santa Ana? Does the First American Title Company finalized plans address the community's concerns?

        Key Terms: Community Engagement, Civil Participation, City Government, Community, Displacement, Urban Planning, and Neighborhood Districts.

Introduction

        Community engagement is the process in which the governmental leaders and developers build relationships with the community activists, disadvantaged population, and city residents. History shows that this level of civil partnership has not been prioritized in development projects for many American cities. However, community engagement should be a greater part of the decision-making process for policies, programs, and developments (Fedorowicz, 2020). Cities need to work more collaboratively with its local citizens, people with special interest, or the financially vulnerable individuals (Barnes & Schmitz, 2016). This research will be focusing on the City of Santa Ana as a case study to improve community engagement.

        In the early to mid-1900s, the population of Santa Ana was primarily White, wealthy individuals, but the demographics transitioned to mostly Hispanic or Latino individuals in the 1970s (Gonzalez 2011). In the past five years, Santa Ana's downtown area transformed, with an increase in new businesses that cater to higher-income clients and customers. Cindy Carcamo (LA Times) reports that Santa Ana's downtown area, known as Calle Cuatro, was a marketplace for primarily Spanish-speaking immigrants for generations, seeking goods and services often found in their homeland. Carcamo states, "Community organizers argue that outsiders, in coordination with city officials, are systematically attempting to erase an immigrant enclave in a city that is almost 80% Latino by bringing in gourmet restaurants and hipster shops and pricing longtime residents out," (LA Times, 2016). The frustration that these community organizers have about the changes occurring in Downtown Santa Ana are similarly felt by other people experiencing cultural erasure in a gentrification movement across many American cities. Since the 1990s, there has been

accelerated gentrification by governmental, corporate and public-private partnerships; consequently, leaving standing business owners in Downtown Santa Ana and a majority of the population out of the development process (Gonzalez & Sarmiento, 2017).

        This research aims to analyze the community engagement of a specific project in Santa Ana to be utilized as a case study for how to improve community engagement in other gentrifying cities. The focal project is the First American Title Insurance Company building bounded by N. Main, N. Bush, E. 4th, and E. 5th streets, which is a popular area for Hispanic individuals in downtown Santa Ana.

        The goal is to utilize the ongoing First American Title Insurance redevelopment project as an example of community engagement in Santa Ana that will then be analyzed for effectiveness. Moreover, the level of effectiveness will be determined by how the development planners incorporated the concerns and/or ideas of the public into the finalized plans of this project. Anything left unacknowledged will be critiqued as a flaw in the quality of community engagement being conducted by development planners in Santa Ana.

Literature Review

The following three sections describe the research problem, research purpose, and context of the area of study.

1. Quality of Community Engagement

        The focal issue is the quality of community engagement in gentrifying cities like Santa Ana that need better community outreach to prevent further issues like gentrification. Displacement and gentrification are a problem in most cities due to accumulated factors such as increased housing prices, newer development, and lack of adequate community engagement. Although the quality of community engagement occurring today in cities has improved, it is still not as effective as it should be. While there are greater incentives to hold community engagement meetings, there is not sufficient outreach being conducted to notify community members of these meetings with ample time to attend these public events.

        The City of Santa Ana has been gradually changing, but there has been an increased fear of greater displacement and gentrification from residents, occurring in their neighborhoods of Santa Ana (Gonzalez & Sarmiento, 2017). The importance of improving community engagement is for the project, program, or service to be successful and intertwined with the existing residents seamlessly. In order to be more effective in planning, public leaders must adopt new approaches to avoid top-down mannerisms. Top-down approaches consist of elected officials and public leaders creating and implementing programs and development without including the community activists and intended beneficiaries. If public leaders approach social issues with a top-down manner, the government's actions will be more likely to fail (Barnes & Schmitz, 2016). Public servants must extend their neighborhood outreach past sending property owners notices and posting planning activities outside the City Hall corridors. The local government is a guidance for the development and policies taking place in a municipality, and they determine what development occurs in the city. Most importantly, planners and developers must understand how the project's neighborhood interacts, the community's identity, and learn their needs & wants (McCloskey, D et al, 2011).

2. Analyzing the City's Outreach

The main intent of this research will be to analyze the current community engagement of a specific project in Santa Ana to utilize this as a case study for how to improve community engagement in similar, gentrifying cities. Community engagement is an important tool to battle displacement and gentrification, but it is not the only factor that could prevent further gentrification and displacement. The objective is to assist the City of Santa Ana in expanding their community engagement process to encourage more residents to share their input on governmental actions. In addition, governmental leaders developing a better partnership with the community will lead to conducting effective, successful plans in their city. This research will take a qualitative approach by conducting interviews via Zoom with the Project Team of the First American Title Company project, which consist of Ali Pezeshkpour and Margarita Macedonio. The original project team consisted of Ali Pezeshkpour, Candida Neal and Scott Kutnick, however Candida Neal and Scott Kutnick have retired from the City of Santa Ana. Margarita Macedonio reviewed Scott Kutnick's notes and documents from the First American Title Company to be informative during the meeting via Zoom. Then, I will conduct an online survey to compare it to the input given in the meetings held by the developers and planners. Furthermore, I will highlight how the concerns or ideas were incorporated into the finalized, approved plans of the First American Title Company project.

3. History & Demographics of Santa Ana

The Santa Ana Historical Preservation Society described Santa Ana as an area with over 27 square miles found 33 miles south of Los Angeles and 12 miles inland from the Pacific Ocean (Goddard & Goddard, 1988). The Orange County Communities Organized for Responsible Development (OCCORD) states the city of Santa Ana is one of Orange County's oldest cities. The first, recorded development known as Santa Ana is traced to William H. Spurgeon in 1869 (Goddard & Goddard, 1988). The development borders being First St. at the south, West St. (now Broadway) at the west, Seventh St. being north, and Spurgeon St. being east (as shown in Figure 1).

Figure 1. Edited Google Earth image to display William H. Spurgeon's first development in today's setting.

The red zone is Spurgeon's first development project, which is now part of the Historic French Park district. There are 64 Neighborhood Associations created in Santa Ana to encourage citizen participation, and this red zone is divided between the Downtown Neighborhood Association and Lacy Neighborhood Association. The Lacy Neighborhood is found in the Census Tract 750.02, and the U.S Census "Hard-To-Count" data analyzes this tract for crowded units, non-high school graduates, and below 150% of poverty level individuals. The results displayed 112 individuals out of 8,022 individuals in this census tract to be categorized into the Hard-To-Count (HTC) Index, which is 1.4% of this section in the City of Santa Ana. For further visualization of the census tract being analyzed, the latest Census Tract Population Density map on Social Explorer (2018) was used to understand the project site within the larger tract:
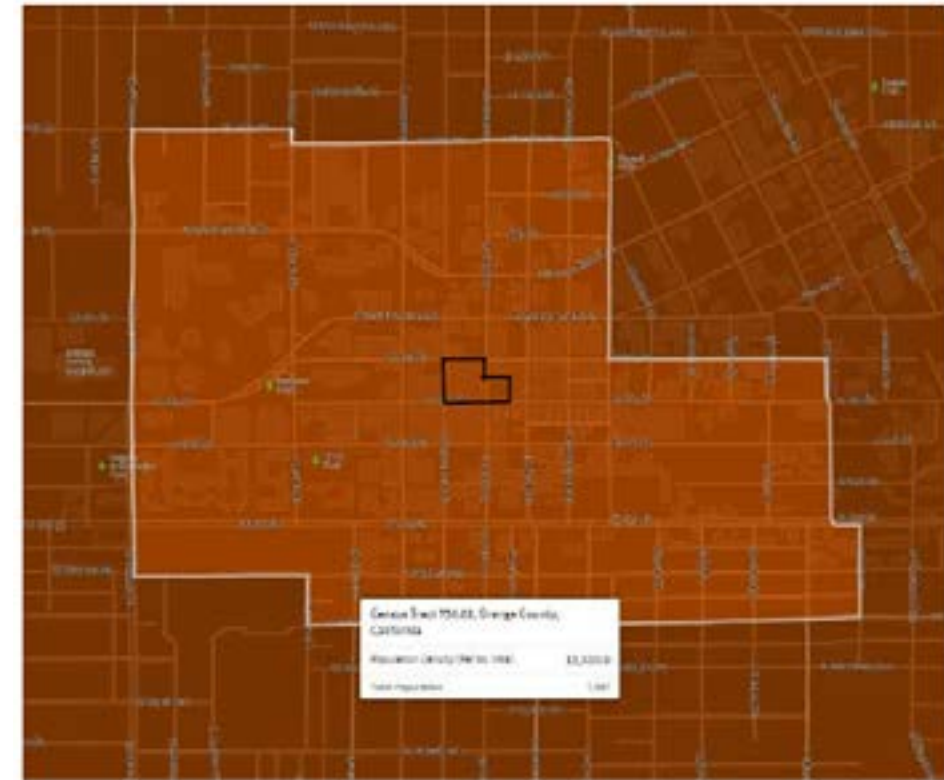
Figure 2: Social Explorer (2018) Census Tract Population Density Map with Project Site traced in black.

Additionally, the U.S Census latest "Hard-to-Count Fact Sheet" states that the total population of Santa Ana consists of 334,493 individuals with 77.3% being Hispanic or Latino, 11.4% Asian, 9.4% White, and 0.8% Black or African American (ACS, 2013-2017). In addition, the California Census states there are 130,657 individuals (5 years and older) who do not speak English "very well". Of those individuals, 83.9% are Spanish speakers and 11.7% are Vietnamese speakers with 1.4% being other Asian and Pacific Island language speakers. Furthermore, the city has 39% of its population speaking other languages besides English, so this limitation makes it difficult for effective community engagement to occur. The City of Santa Ana's large Hispanic population is so vast that it has impacted the U.S Census for the city to label individuals as "non-Hispanic White" (U.S Census, 2020).

Since the population of Santa Ana was primarily White in the early to mid-1900s, the city officials were also White individuals who were focused on serving the wealthy, White community, considering they provided the most to the economy to fund the development

projects (Gonzalez, 2011). Once White Flight took place in the 1970s, the house value in most of Santa Ana dropped and the property taxes dropped as well due to the 1978's Proposition 13 (1% leniency on property tax). Gonzalez (2011) states Santa Ana's city planning vision in the 1970s was to "de-Mexicanize, de-immigrant, de-concentrate poverty, and re-Whiten the downtown area," (page 23). These terms utilized by the public leaders has set the tone for urban planning in the city for the following decades. This vision has been harmful to have public servants aiming to displace the current population to re-attract wealthy, White consumers (Gonzalez, 2011). This period of history in Santa Ana portrays the need for community engagement. Planning without public interaction takes on Robert Moses' top-down approach and allows development to occur without consultations from the public or understanding the impacts of the residents in the area near potential development (Barnes & Schmitz, 2016). Gonzalez confirms that the city planning representatives felt the increase of Mexican immigration and Mexican businesses catering to the new population were "frightengly" transforming the downtown area. The city officials further described the transition to be a "blemish" to the city's previous upscale, White identity. Although traditional city planners have held such preconceptions, these prejudices are unfit for public services that create policies and programs for their designated municipality.

Furthermore, the OCCORD announces a majority of Santa Ana households fall on the lower-income spectrum by examining the median household income of city inhabitants. Comparing the median household income of the residential population to the housing

affordability, it is clear that rent is extremely high for most of Santa Ana residents (OCCORD). The following chart displays the difference between Santa Ana and the rest of Orange County population in terms of household income and housing affordability.
Figure 3: Household Incomes and Housing Affordability by Orange County Communities Organized for Responsible Development (OCCORD).

This chart portrays the financial disparities between the population of Santa Ana and the rest of Orange County. In addition, the American Census Survey affirms the home prices are moderately lower in Santa Ana than the rest of Orange County, but the median household income is proportionally lower than the rest of Orange County. This suggests that the housing costs are too high for the median household income in Santa Ana, so it would be difficult for families to build assets or generational wealth.

Community Engagement in Santa Ana
Planning efforts in engagement have progressed in most areas, but the city of Santa Ana (along with a few other cities in California) have pushed towards activating their civil engagement with the Sunshine Ordinance policy. The Santa Ana Sunshine Ordinance was approved in 2012 with the goal to make planning more transparent, educational, and easier to access public records (Cavazos, 2016). In order to do this, the city will update their public website, 10 years of budget information and audited financials, Quarterly Budget Updates, and a Strategic Plan monthly update online. The Sunshine Ordinance Meeting for the First American Title Company project was held on June 18, 2018 from 5:30-6:30 P.M (McCann, 2018). The purpose of the meeting was to provide information to the surrounding community about the applications submitted to the city for the proposed mixed-use project. This project's community outreach consisted of:

o Mailed notifications in English and Spanish to property owners and occupants within a 500' radius to the project in 2018
o Photos of Meeting Notices posted on 3 different locations on the project property
o English and Spanish Meeting Notifications in the Orange County Register published on June 7. 2018 (11 days before meeting) (McCann, 2018).

With this form of outreach within two weeks before the official meeting, there were 21 individuals that attended the Community Open House hosted by the development planners.

The developers and planners described the project and introduced the project team to the public. Briefly, the project is an entire block in Downtown Santa Ana that is being proposed as a mixed-use complex, which was originally the Orange County Title Company in 1966. Underneath the current façade, there is a veneer of sheet metal and brick, which was a 1931 Art Moderne building designed by Alan Ruoff (Nicholds, 2019). The environmental report declared there is no historic structure on the site due to the façade covering the historic building underneath. Despite the report, the city has agreed to preserve and design in accordance with the pre-World War II structure. In addition, this mixed-use complex will have 218 apartment units and a parking garage for residents and guests. When one of the participants in the meeting asked about affordable housing in downtown, there was not a response given. This participant continued to express concern for displacement because the rent is already increasing in the downtown area (McCann. 2018).
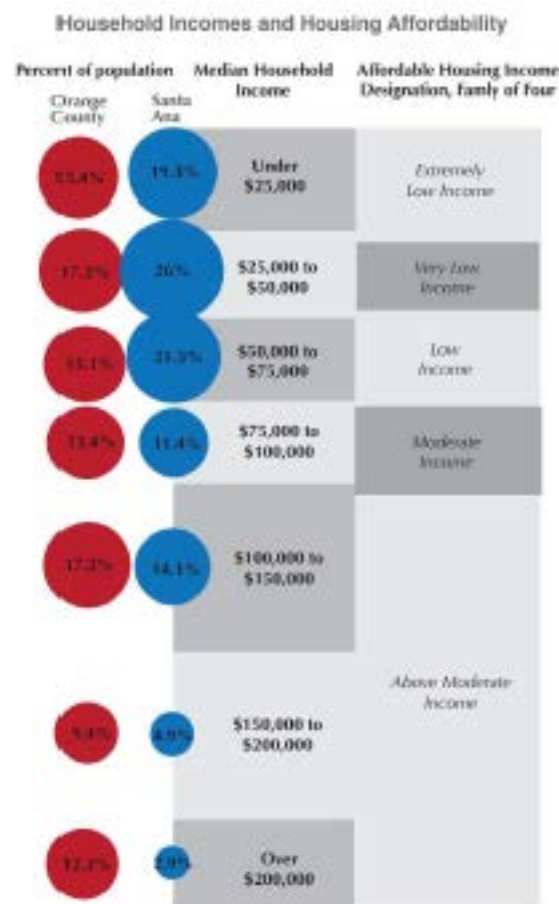
When there is a lack of community engagement, there is a top-down approach being taken that directly affects the vulnerable population through increased housing prices, displacement, etc. Another aspect that these vulnerable individuals are affected by newer development is social and emotional damage. Lei Ding (2015), Jackelyn Hwang (2015), and Eileen Divringi (2015) establish that when low-income households are displaced from their gentrifying neighborhoods, they are more likely to move to higher racially segregated and poorer neighborhoods, which falls into a cycle of "root shock" in housing instability. These are some of the consequences that could happen to the extremely low-income population in Santa Ana if the city continues to neglect community needs and cater to different audiences.

Moreover, David Jarvis (2012) emphasizes the quality of life in disadvantaged neighborhoods has not improved despite local governments establishing models of "area-based regeneration" such as Community Benefits Agreement or Strategic Plans. These are fundamental steps, but there is still so much outreach to be conducted by public servants. The Orange County Communities Organized for Responsible Development (OCCORD) defines the Community Benefit Agreement (CBA) as an agreement between the city, developers, and the community. The CBA requires new public and/or private development to conduct community engagement, which challenges gentrification and allows community members to provide input on the City's activities. Usually, the developers take initiative for community engagement for tax break incentives, tax subsidies, or special exemption from development standards.

For example, the Staples Center Community Benefit Agreement in Los Angeles covered a project receiving subsidies estimated up to $150 million in public funding because the CBA ensured that 70% of jobs created would pay a living wage, $1 million from the developer towards park & recreation needs in the area, first source hiring program to target job opportunities to low-income displaced by the project, and increased affordable housing requirements for the project, etc. The community benefits from this project were increased job opportunities, funding for parks and open spaces, and hiring prioritization to individuals displaced. However, this project is an example of how development will be approved in an area with economically vulnerable individuals and provide some incentive to address the displacement and gentrification the project will cause, but the developer will still benefit more than the community it displaced and/or gentrified. Furthermore, the 'community benefit' is personalized to each city and its community's needs, but it generally allows each city to establish the benefits that public or private development will need to fulfill, especially when taxpayer funding is being used. In Santa Ana, the community-led organization, OCCORD, has created the Santa Ana Collaborative for Responsible Development (SACReD) coalition to ask the city to sign a Community Benefits Agreement for security and protection of future development (Santa Ana. 2010).

Instead, Santa Ana has set a Strategic Plan with a series of seven goals, with the seventh goal aiming towards an effective and "customer-friendly" government (2016). This goal will be made possible through establishing community engagement as the organization's primary focus and establishing communication plans to inform employees and the community about city activities. Essentially, their aim is to prioritize community engagement by informing employees and the community of the city's plans and policies as transparent as possible. Specifically, the city has created steps to fulfill these goals of engaging the community and they are the following:

  o Annually conduct a statistically valid random-sample community satisfaction survey to assess satisfaction with the delivery of major City services
  o Conduct an annual volunteer "day of service" where City employees volunteer in community
  o Use City display cases to inform and showcase each department to the community
  o Develop communication policies addressing the type of matters that will be promoted to employees/public and the internal process to ensure timely distribution
  o Utilize new technologies such as Facebook, Twitter, Nixle and CTV3 to interact with employees and the community
  o Invest in software/resources that will help streamline the flow of information to City staff and the public (Santa Ana, 2016).

OCOORD announces Santa Ana has been engaging in strategic and long-range planning efforts by adopting a Five-Year Strategic Plan and updating the City's General Plan, but "the current approach to development is not enough," (page 9). Despite the city setting goals to become more transparent to the public, there needs to be more action taken from the local government to renovate their public outreach and civil participation such as spreading community meeting notice all around the city's streets like city officials do for local elections.

How to Improve Community Engagement

The importance of practicing and improving community engagement is to refocus the projects/development back to the community, identify ethical pitfalls, understanding cultural dynamics, and enhanced knowledge of neighborhood given by the locals (McCloskey, D. et al, 2011). It is suggested to build evidence about the policies, development, and programs that prove to be most effective, so the policymakers will make the best decisions with the community in mind. In addition, alternative strategies consist of limited taxpayers funding being utilized for the practices and governmental actions, but then redirect funds if the projects are unsuccessful or not obtaining desirable outcomes (Barnes & Schmitz, 2016). Ultimately, action needs to be taken to integrate the public into the problem-solving and producing solutions that give the best outcomes for the inhabitants.

Local governments often are more impactful on residents than state or federal governments, and civic engagement has been made more possible in this digital era (CivicPlus). Community engagement is a multi-step process that requires both in-person and online communication. In a time of social distancing, public involvement has moved virtual, and social media has boosted individuals to participate in their local government through activism, attending city council meetings, voting for better city representatives, etc. (Fedorowics, 2020). Community engagement includes civic action or community volunteerism, civic skills such as employee training and recruitment, social cohesion, and civic commitment in terms of voting (CivicPlus). These aspects are all included when discussing civic engagement, and the local government setting the tone of transparent, well-intentioned services to encourage the residents to work collaboratively with the city. Community engagement is necessary for city planning due to the following:

· Inhabitants of the city can notice issues in the city such as broken streetlights faster than a few planners can, especially with a large city like Santa Ana
· The city population's concerns and ideas should be integrated into the development, policies, and programs, considering it is directly impacting their neighborhoods
· The local government will only understand the area on a superficial level without integrating themselves into the city, which is accessible through in-depth community interaction (CivicPlus).

In a local government, they are the leaders of the city and must guide the community engagement process. A foundation for community engagement is regular public forums, accessibility to public records, transparency in areas like agendas, budget allocations, and more (CivicPlus). A community engagement continuum looks like this:

Figure 4. Principles of Community Engagement (McCloskey, D. et al. 2011).

This community involvement table provides fundamental steps for governmental leaders to implement such as outreach, consultations, involvement, collaboration, and shared leadership. With many cities adapting the outreach step, it portrays the minimal effort in civil interaction since outreach is only one aspect of the levels of community involvement. A step further is consultations that requires public participation to share proposal alternatives and/or analysis to be acknowledged by the city officials. In addition, involvement implies conversations with the neighborhood to understand and consider the public aspirations and concerns through workshops and sampling. Finally, collaboration and shared leadership empowers the community participants to be a part of the problem-solving until the local government implements what the public decides (Fedorowics, 2020). This final step is the approach that governmental leaders need to transform their engagement into through citizen advisory committees, consensus building, delegated decisions, and citizen juries.

Furthermore, there are unconventional aspects of community engagement that must be addressed to enhance the partnership & understanding of the project's immediate neighbors. Civic engagement leaders, especially in low-income areas like Santa Ana, must look at the quantity of residents who depend on public transportation, residents with children, residents who have multiple jobs, etc.

This would allow their planning for community outreach to be more effective by understanding what time to conduct engagement meetings and encouraging residents to participate with transportation-fee waivers. These unconventional approaches will boost and activate public involvement to ultimately reach participatory decision-making.

Methodology
This section discusses the two methods being conducted in this research (Policies/Sample Cases and Interviews) to address the quality of community engagement occurring in gentrifying cities like Santa Ana.

Policies/Sample Cases

The materials being collected consist of Santa Ana's Strategic Plan, the Sunshine Ordinance policy, and sample cases to reference successful strategies to enhance community engagement. There will not be a limit on how many policies can be collected, so the number of policies used will be determined to relevance and importance. There will be no more than two sample cases used as references for the main case study, First American Title Company project.

From the various policies and sample cases relevant to community engagement, I will dissect the information to be most relevant to activating civil participation. The objective is to gain step-by-step models to improve community outreach and personalize these steps to Santa Ana as our focal case of study. After dissecting the valuable information from the policies, case studies, or journals, I will formulate effective procedures and suggestions to improve community engagement in Santa Ana.

Through the qualitative approach, the analysis process will consist of annotations from public documents, journals, and books about community engagement. The information collected will be combined to create a large, step-by-step model to expand community engagement that can be utilized in other American cities, attempting to partner with their community to prevent further gentrification and displacement.

Interviews

At this stage, there will be interviews via Zoom with the Project Team of the First American Title Company project, which consists of Ali Pezeshkpour and Margarita Macedonio. In addition, there will be a meeting via Zoom with the developer for Toll Brothers, John Hyde.

The questionnaires conducted at this stage will be open-ended to gain insight to information not available from public documents or design plans. The general data desired is general information about meetings & public feedback, reasoning behind decision-making, suggestions for outreach improvements, what they could have done differently, etc. Some of the questions that will be asked are: Describe the general demographics of the public who attended the Sunshine Ordinance Meeting. How would you create a better partnership with the local community? What outreach efforts would you have done differently?

This data will be collected mainly through set Zoom interviews, but some information can be transferred through e-mail. My analysis approach is qualitative because I will be using the verbal data to provide evidence and verification of local comments about the development project. In addition, I will decode the information gained from each interview and categorize the feedback from the respondents. Furthermore, the information given will be verified through public documents to determine whether the public records convey the same information the project team will give. Also, I will determine whether the interview information and data translate onto the public records clearly. If there are concerns and/or opinions that was not addressed by the planners or developers, it will be marked as a flaw in the civil engagement conducted by the City of Santa Ana and the Toll Brothers Development Company.

Findings

As far as the public documents of the First American Title Company designs portray, this project will be a mixed-use development that will provide retail spaces on the first level and residential spaces above. The development project consists of two parcels, Parcel 1 & Parcel 2. Parcel 1 is the main structure with 7 stories for residential and retail spaces with underground parking whereas Parcel 2 has 5 stories dedicated to parking spaces. There are 218 apartment units proposed and approximately 11 units will be Affordable Housing units available for individuals in the very low-income bracket. In addition, there will be a rooftop deck and parking that will be accessible to all residents. As for the sustainability aspect of the design, the developers aim for LEED Silver Equivalent and incorporating as much green as possible on the site. Typical construction for this type of project is 2 years, but construction has been delayed due to COVID-19 limitations (Santa Ana).

The City of Santa Ana requires each project and policy to conduct a community outreach meeting called the Sunshine Ordinance meeting before submitting the project or policy for city council approval. At the Sunshine Ordinance meeting on June 18, 2018, the public was informed about the proposed designs and purpose of the First American Title Company project. The meeting was held at the First American Title Company building on 111 East 4th Street in downtown Santa Ana at 5:30-6:30 PM. Community members were given 11 days in advance to plan to attend the Sunshine Ordinance meeting. The meeting notification was mailed to property owners and occupants within a 500' radius in English and Spanish, photos of meeting notices were posted on the project site, and the meeting was publicized on the Orange County Register in English and Spanish. Susan Case Inc. provided the list of property owners and residents within 500' radius for the City to send out notifications through mail. With 11 days given in advance for the community to prepare for the meeting, there were only 21 attendants and 4 of the individuals were claimed City Staff. The Sunshine Ordinance attendants were given a hard copy of the PowerPoint presentation to follow along and review after the meeting (Santa Ana).

The Sunshine Ordinance participants were concerned with historic preservation, affordable housing, rooftop design, gentrification, displacement, parking availability, etc. Furthermore, the community's concern led to two separate community meetings to further analyze the preservation and neighborhood concerns (Santa Ana). The preservation groups, such as Preserve Orange County, met with the Toll Brothers developers and the City of Santa Ana planners to further discuss the recent preservation plan before issuing permits to Toll Brothers to undertake demolition and reconstruction. The First American Title

Company project was approved by the City Council on December 3, 2019 with the conditions to address the community's vocalized concerns. Therefore, on March 16, 2020, the City began searching for the historic pieces on the corner a community member had mentioned. Corner pilasters and windows with more Art Cevo ornament were revealed on March 17, 2020 (Preserve Orange County). In July 2020, Dunbar Architecture team confirmed with the Toll Brothers and the City of Santa Ana that the historic fabric was intact. The preservation plan, or "preservation alternative', is to restore the 5th Street and Main Street facades and to integrate it with the new building (Preserve Orange County). As for the Neighborhood Meeting, the City of Santa Ana held a joint meeting with four of the City's Neighborhood Association on June 11, 2019. The four neighborhoods chosen, due to close proximity to the project site, are Lacy, Logan, French Park, and Downtown (Macedonio).

In addition, there were two meetings conducted with the City of Santa Ana and Toll Brothers Company. The first meeting was with John Hyde, a developer for the Toll Brothers Company. On April 9th, John Hyde discussed the demographics of the outreach participants, stating there were White, Hispanic, and Asian individuals who ranged between 40-60 years in age. Hyde declared the rooftop amenities consisted of a communal area, BBQ grill, foosball tables, fire pit, trellis area, etc. As for the community events held on the rooftop, City Planners are in the process of creating occasional community events with local organizations. Hyde confirmed that there will be 11 Affordable Housing units available for individuals in the very low-income bracket.

The second meeting was with Margarita Macedonio, City of Santa Ana Planner, on April 23rd, 2021. The First American Title Company Project Manager, Ali Pezeshkpour, was unable to attend. Margarita Macedonio had reviewed Scott Kutnick's documents to fill in for his spot since Kutnick had retired this past December. Although Macedonio had not been a part of the First American project, she is very familiar with the City of Santa Ana Community Outreach process and the Neighborhood Associations. Macedonio gave insight on the 64 Neighborhood Associations in Santa Ana and how the neighborhood districts function. Typically, the districts' challenge the City's proposal, questioning what the plan is, how the residents will benefit, and who the City is planning for. Macedonio continued to state how these vocalized concerns shape public policies, and it is a part of the relationship between the City and the locals to address these healthy conflicts.

Analysis

From the findings, I am able to infer that the City of Santa Ana has a great foundation for community outreach with the city divided into neighborhood corridors that are mostly active in advocacy. Santa Ana is pushing towards greater community outreach with community meetings being a requirement for City Council Approval such as the Sunshine Ordinance Meeting. Also, the Sunshine Ordinance Meeting led to a continuation of community outreach meetings such as the Historic Preservation meeting and the Neighborhood Association meeting. This is a great start, but there still resides a disconnect between the local government and the community.

On April 9th, John Hyde gave me insight on the design layout and participant demographics, but he also gave me insight on what he would do to improve community engagement. Hyde stated that the community felt as if the city planners were trying to sneak this project past them, but that was not the case. In addition, the project structure was not

classified as a historical building, so the site was not inspected as a historical site. Also, Hyde recommended that the City Planners made the community a part of the process earlier on and maintained the historical society updated.

On April 23rd, the meeting with Margarita Macedonio gave me a greater understanding of the public participation and importance of community leaders. The City of Santa Ana has a different foundation than other cities, considering the city is divided by self-proclaimed neighborhoods rather than city-determined boundaries. Furthermore, Macedonio determined that the neighborhoods applied to grants for community leader workshops and improved their own understanding of how the city government functions. The neighborhood associations are reaching further to connect and understand the city governmental officials, yet the disconnect remains. It is the governmental officials' duty to bridge the misunderstanding, miscommunication, and disagreements. There are many recommendations for the city government to apply such as branching out from the required outreach efforts, creating a trusting partnership, etc. An interesting recommendation Macedonio provided was for the city to create an alliance with faith-based leaders, landowners/apartment managers, school principals, etc. to be the trusted channels of communication to pass onto the public.

Recommendations

From the project documents reviewed and interview data collected, I would recommend the City of Santa Ana to create informal settings for the community to participate, involve the community more in the design aspect of projects or policies, and build stronger partnerships with the community through collaboration.

According to the Principles of Community Engagement: Second Edition, Donna Jo McCloskey, et al. discuss the steps of community engagement which are the following: Outreach, Consult, Involve, Collaborate, and Shared Leadership. McCloskey et al state that 'Outreach' is the beginning stage where there is some community involvement and the community is communicated valuable information, but the city government and community merely co-exist. In the following stage called 'Consult', there is more community involvement where the community communicates back information to the city officials, yet there is only information being shared back and forth. This is the stage that the City of Santa Ana is currently in. Afterwards, the next stage is called 'Involve' which means there is better partnership being developed by increased cooperation. In the succeeding stage called 'Collaborate', there is a growing communication flow from both sides during the whole process of the project or policy; in addition, there is trust building through this collaboration stage from development to solution. On the final stage called 'Shared Leadership', there is a strong, bidirectional communication between the city government and community. This is the optimal stage for community engagement because the final decision-making is at a community level where the community trusts the city officials to address and resolve issues vocalized.

The importance of practicing and improving community engagement is to refocus the projects/development back to the community, identify ethical pitfalls, understanding cultural dynamics, and enhanced knowledge of neighborhood given by the locals (McCloskey, D. et al, 2011). It is suggested to build evidence about the policies, development, and programs that prove to be most effective, so the policymakers will make the best decisions with the

community in mind. In addition, alternative strategies consist of limited taxpayers funding being utilized for the practices and governmental actions, but then redirect funds if the projects are unsuccessful or not obtaining desirable outcomes (Barnes & Schmitz, 2016). Ultimately, action needs to be taken to integrate the public into the problem-solving and producing solutions that give the best outcomes for the inhabitants. Projects that integrate the community's needs during the development process are often more successful and accepted by a community. Community engagement is necessary for city planning due to the following:

· Inhabitants of the city can notice issues in the city such as broken streetlights faster than a few planners can, especially with a large city like Santa Ana.
· The city population's concerns and ideas should be integrated into the development, policies, and programs, considering it is directly impacting their neighborhoods.
· The local government will only understand the area on a superficial level without integrating themselves into the city, which is accessible through in-depth community interaction (CivicPlus).

In a local government, they are the leaders of the city and must guide the community engagement process. A foundation for community engagement is regular public forums, accessibility to public records, transparency in areas like agendas, budget allocations, and more (CivicPlus).

Local governments often are more impactful on residents than state or federal governments, and civic engagement has been made more possible in this digital era (CivicPlus). Community engagement is a multi-step process that requires both in-person and online communication. In a time of social distancing, public involvement has moved virtual, and social media has boosted individuals to participate in their local government through activism, attending city council meetings, voting for better city representatives, etc. (Fedorowics, 2020). Community engagement includes civic action or community volunteerism, civic skills such as employee training and recruitment, social cohesion, and civic commitment in terms of voting (CivicPlus). These aspects are all included when discussing civic engagement, and the local government setting the tone of transparent, well-intentioned services to encourage the residents to work collaboratively with the city.

After analyzing project documents and interviewing some of the project representatives, I had found that the City of Santa Ana is taking efforts to address the community's concerns, but the community does not trust the city officials. The residents of Santa Ana feel betrayed by the City repeatedly with delayed information and misrepresentation in new development (Macedonio). The City of Santa Ana has a unique neighborhood layout where the neighborhood districts are actively empowering themselves to connect with the city government. For example, each neighborhood in Santa Ana has leader representatives, and some neighborhoods, like the Lacy neighborhood, earn grants to provide leadership training to understand city government processes (Macedonio). Therefore, the City of Santa Ana could resolve the mistrust in their relationship with the community by involving the local residents at the beginning of every development. By informing and collaborating with the public from the beginning in the development, the neighborhood districts will form a strong partnership and empower the neighborhood

leaders to encourage greater participation to their neighbors. In addition, the city government could extend their public meetings from City Hall or project sites to popular, local spots. By the city government reaching out to the community, there is an informal setting being placed that removes hostility or intimidation to participate in the conversation or meeting. In order to involve the public from the beginning of a project, the City should hold informal art meetings where coloring supplies are provided to allow the public to draw development they would like to see in their community (conceptually or visually). Furthermore, these informal art meetings would allow the City to have a greater understanding of the community's needs and design preferences.

Overall, the recommendations I have for the City of Santa Ana to go from the 'Consult' stage to 'Shared Leadership' stage:

1. Create informal settings for the community to participate.
    i. Reach out to the community where locals gather such as parks, malls, etc.
2. Involve the community more in the design aspect of projects or policies.
    i. Informal art meeting where the public draws what they would like to see in their community (conceptually or visually).
3. Build stronger partnerships with the community through collaboration.
    i. Build trust with the community by involving the community in the development process from the beginning.

Conclusion

In conclusion, community engagement is the process in which the governmental leaders and developers build relationships with the community activists, disadvantaged population, and city residents. History shows that this level of civil partnership has not been prioritized in development projects for many American cities. However, community engagement should be a greater part of the decision-making process for policies, programs, and developments. The importance of improving community engagement is for the project, program or service to be successful and intertwined with the existing residents seamlessly. In order to be more effective in planning, public leaders must adopt new approaches to avoid top-down mannerisms. Overall, this study will translate how the community participants' concerns & ideas were integrated into the finalized plans for the First American Title Company project. In addition, this project will be utilized as a case study to determine the effectiveness of their community engagement process. With the right intentions, tools, and a majority of the public's voices, community engagement could lead to successful programs, policies, and development to benefit the residents foremost needs. At a larger scale, many cities are taking similar approaches like Santa Ana with minimal community engagement efforts, so Santa Ana could be used as a case study for others to determine how to expand their community engagement process.

Furthermore, the research aim was to discover whether the First American Title Company project addressed the community's concerns of the project and how to improve the City of Santa Ana's community outreach through this project as a case study. After analyzing project documents and interviewing some of the project representatives, I was able to concur that the City of Santa Ana is taking efforts to address the community's concerns, but the community does not trust the city officials. The residents of Santa Ana feel betrayed by the City repeatedly with delayed information and misrepresentation in new

development However, by informing and collaborating with the public from the beginning in the development, the neighborhood districts will form a strong partnership and develop trust in the city government. In addition, trust will also grow when city officials strengthen their neighborhoods during informal meetings in popular, local spots. Through informal conversation, the partnership will improve between the city government and residents in order to reach shared leadership and accurate representation of the City.

Timetable
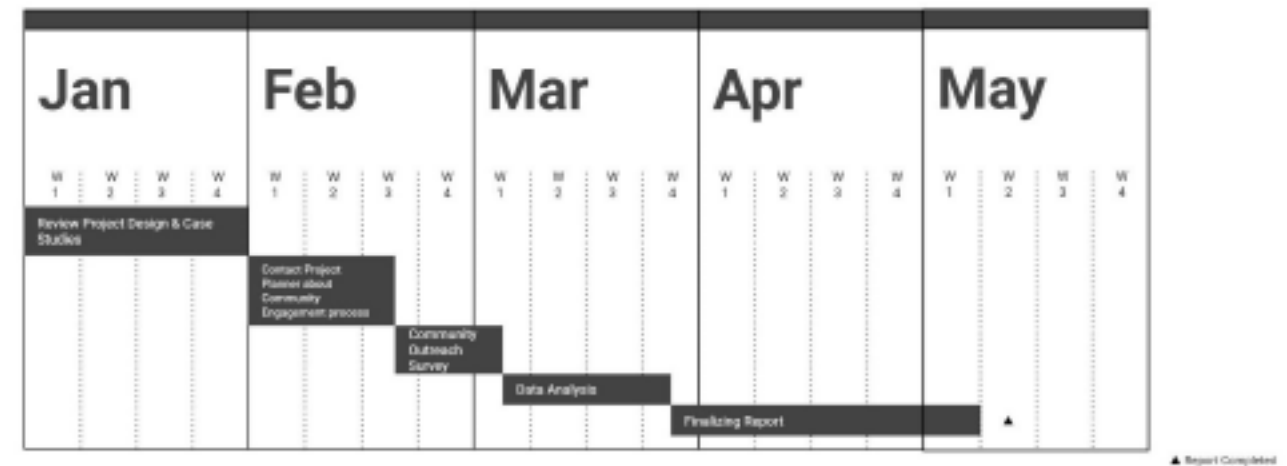
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Flores   **Investigating the mechanisms of immunity to Trichomoniasis-**
Barbara

Abstract

Trichomoniasis is one of the leading Sexually Transmitted Infections (STI) in the United States and it is caused by the unicellular parasite Trichomonas vaginalis (Tv). Infection with Tv may increase additional health risks through increasing the rate or malignancy of another disease, and there is no vaccine currently available on the market. Once infected with a pathogen such as Tv, white blood cells known as neutrophils aid the immune system as the first line of defense against the infection. Additionally, while neutrophils have multiple means of effectively killing pathogens, a novel method known as trogocytosis is used against live Tv. During trogocytosis neutrophils swarm the parasite, ultimately surrounding it in order to take 'bites' and kill the parasite. There is still much unknown about trogocytosis such as the involvement of surface-level receptors, however, we hypothesize that the surface-level receptor CR1 helps mediate the process of trogocytosis, due to its involvement in phagocytosis, adhesion, and its other associations with innate immunity. Understanding the cellular and subcellular mechanisms in which Tv are trogocytosed will aid in creating a preventative treatment, and improve treatment for after an infection.

Introduction

The unicellular parasite Trichomonas vaginalis (Tv) causes the Sexually Transmitted Infection (STI) trichomoniasis. Although trichomoniasis is one of the leading STIs in the United States it remains a neglected disease due to the lack of research on the subject (Secor et al., 2014) . There is currently no preventative medication or vaccine available for trichomoniasis; however, antibiotics metronidazole or tinidazole are commonly prescribed to individuals infected with Tv (Centers for Disease Control and Prevention [CDC], 2017). It is known that the parasite adheres to host cells through cytoadherence, in which it alters its structure (Mercer & Johnson, 2018). Cytoadherence is believed to broaden host cells surface area coverage, and Tv primarily targets host epithelial cells (Midlej & Benchimol, 2010). Additionally, infection with Tv may increase the rate of a disease such as human immunodeficiency virus (HIV) or the malignancy such as cervical cancer in the case of co-infection with human papillomavirus (Bhakta et al., 2020).

One of the most common symptoms of Tv is inflammation which is caused by a type of leukocyte known as neutrophils. Neutrophils are established to be a part of the first line of defense involved with innate immunity. They are also largely associated with inflammation as they release inflammatory cytokines such as IL-8 which induce the release of pro-inflammatory factors, effectively recruiting additional neutrophils (Kołaczkowska & Kubes, 2013). In addition to this neutrophils have the capability of recruiting other neutrophils more precisely to the site of the injury by releasing leukotriene B4 (LTB4) (Lämmermann et al., 2013).

There are several ways by which neutrophils are known to effectively kill pathogens, including phagocytosis, degranulation, and the release of NETs otherwise known as NETosis; however, trogocytosis to kill a pathogen is currently novel to Tv, and differs from all

other methods (Bhakta et al., 2020). When neutrophils hone to the site of an infection they do it through transmigration in which they traverse through multiple barriers composed of endothelial cells, basement membrane and pericytes (Kołaczkowska & Kubes, 2013). Neutrophils are also capable of reverse transmigrations which may aid in increasing the lifespan of neutrophils in relation with inflammation (Deniset & Kubes, 2016). In the case of trogocytosis, once neutrophils come across the parasite they will swarm the pathogen ultimately surrounding it in order to trogocytose it (Mercer et al., 2018). A notable difference in trogocytosis as compared to phagocytosis is that trogocytosis is only performed on live Tv while phagocytosis may occur on living and dead cells (Bhakta et al., 2020). Additionally, in trogocytosis the parasite is swarmed by neutrophils which then take 'bites' out of the parasite compared to phagocytosis in which the pathogen is completely engulfed (Bhakta et al., 2020). It is hypothesized death of Tv occurs once there is an excess amount of 'bites' taken from the parasite; however, there is still much unknown on the specifics of trogocytosis.

Open Questions

Although it is known that one of the more notable symptoms of trichomoniasis infection is inflammation and that neutrophils kill Tv through trogocytosis, the exact cellular and subcellular mechanisms of how Tv are trogocytosed are unknown, much of this is due to the novelty of trogocytosis. It is currently unknown whether or not degradation of Tv is amplified by toxic granules or if lysosomes contained in neutrophils are needed to maintain further trogocytosis. However, it is the belief that surface-level receptors such as Fc-Receptors and Complement receptors help mediate the process of trogocytosis due to the contact-dependent nature of trogocytosis and their associations with innate immunity. Thus, we believe that complement receptor CR1 mediates the trogocytosis of Trichomonas vaginalis.

Rationale for Hypothesis section

CR1 surface receptor is a part of the short consensus repeat family also known as the SCR family, this family is defined by a shared repeated domain; additionally, this family is known to play a prominent role in innate immunity (Dustin, 2016). It is also known that surface receptor CR1 aids in adhesion, phagocytosis, and is associated with C3b which functions as an opsonin as it aids phagocytosis by increasing the susceptibility of being phagocytosed; furthermore, CR1 is present on neutrophils (Dustin, 2016). Additionally, data support that phagocytosis is mediated by CR1 through the activation of myeloid cells either through Fc receptors or other various immunoreceptors (Holers et al., 1992). Due to both trogocytosis and phagocytosis being contact-dependent methods that absorb pathogenic materials neutrophils use in killing pathogens it is believed that mechanisms used in phagocytosis may also be crucial in trogocytosis. Thus, we hypothesize that CR1 may be involved with trogocytosis of Tv due to its association with neutrophils and phagocytosis.

Research Strategy

To test our hypothesis that CR1 helps mediate the process of trogocytosis we will use CRISPR-Cas9 to knock out the CR1 gene in order to assess its effects on the neutrophilic killing of Tv in the absence of the CR1 gene. To knock out CR1 its two known DNA gene sequences, and the three mRNA transcript variants were taken from the National Center for Biotechnology Information and analyzed through an open source software ApE (A plasma Editor) which was used to obtain all reverse complements of the sequences.

During cross analysis of the gene sequences we aimed to find three key criteria
1) Gene sequence present in all DNA, mRNA transcript variants or their reverse complements.
2) Presence of a PAM sequence downstream.
3) Preferred sequences closer to the beginning of the DNA, mRNA transcript variants or their reverse complements.

After cross analysis we have selected three suitable gene sequences we believe will work with CRISPR-Cas9 in order to inhibit gene expression.

crRNA sequence	PAM sequence
ATTTAATTGGGATCCGAAC	TGG
CCAAGAAGCCCGGAGCCTGT	CGG
TCTGGACTGGTGCTAAGGAC	AGG

Table 1 Display of the chosen crRNA sequences

Future Aims

For our experiments we will be using neutrophil-like cells known as PLB-985 cells. Next we will purchase our three crRNA sequences, and then we will transfect our PLB-985 cells with our crRNA, tracerRNA, and cas9 enzyme which will create a Cas9 ribonucleoprotein (RNP) complex. Our Cas9 RNP complex then will search for our chosen sequences and will cut at the sequence in order to hopefully create a mutation.

In order to test if a mutation occurred we will purchase a fluorescent antibody stain that will bind to the CR1 gene if present. We will then run our cells through a flow cytometer and if binded we will be able to analyze the effectiveness of the gene knockout as cells with the CR1 gene present will be fluorescent, while with cells that are not fluorescent we can confirm a successful knockout of the gene. After successfully knocking out the CR1 gene we will then be able to continue to experimentally test the effects on the neutrophilic killing of Tv in the absence of the CR1 gene through both parasite killing assays and trogocytosis assays.

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Fonseka Thisuri

Cal Poly Pomona students take on the challenge of wanting to be on their technological devices while maintaining successful social relationships

Abstract

This project examines the effects of technology on social relationships. There has been much debate about whether technology, such as cell phones, have negatively affected our social relationships. Does technology create a closer or deeper relationship from their perspective of the user, or does it create the opposite ?

Using ethnographic methods, we examine the technology habits of students at Cal Poly Pomona and how they experience their social relationships both face to face and online. We employed to carry out our research through participant observation, interviews, and visual analysis. The places we recruited participants were classrooms, the quad area, the Marketplace, and the Bronco Student Center (BSC).

Many of our participants agreed that they would like to engage in social groups where the devices were not the focus. When people are in social settings, they are submersed in their phones and laptops, especially when at school. We examined the reasons for why they are this involved with the devices. We found themes of forced dependency on these devices, as most school procedures including assignments had to be done online rather than handwritten. We also discuss the "agency" of technology devices which "calls" the attention of students. We conclude that there are many reasons that technological devices may have positive or negative effects on social relationships.

We conclude that there are many reasons that technological devices may have "grey" effects, which are those effects that are either intrinsically good or bad on social relationships For example, spending time on the computer for four hours is considered bad for the body as it puts physical strain in eyes and posture, while isolating themselves from the social environment for long periods of time, this is the black effect. But what if these 6 hours spent on the computer were for a research paper or group assignment, that allows for social interaction online, this is for the betterment of one's education, this is the White effect. The 'grey effect' we have identified is the mixture of the two where it is inevitable but also benefactory. A mix of black and white resulting in Grey. The shades of grey may differ depending on person, device, and situation.

Introduction

Our research is focused on understanding how students interact with their technological devices while trying to maintain social relationships. The research question which we address ethnographically is "How does the frequent use of technology affect the social relationships of Cal Poly Pomona Students?"

Technology has begun to widely take over humans' daily life and tasks that once required more effort than are spared nowadays. According to Tim Wu's article on The New Yorker "[society has] suffered traumas, like colonization and the destruction of cultural continuity"(Wu, 2014) because of our impatience to adapt to new technologies, but also due to how quick the human self can adapt to the new inventions and forget life before the 'new'. Society is currently centered around social media and tend to obsess over what is the

'trendiest'. Most of it is related to the new technologies that are released each year which are 'better than ever' or full of 'for the first time only" gadgets and widgets included into the model that comes out every year. Technology in itself is a multi-billion-dollar industry that is producing new products for customer consumption. "According to 2019 data from Statista, $3,360 billion has been spent on technology worldwide" (Today, 2020).

Social media presents students with the ability to be whoever they want to be on the internet with the false promise of "no judgement", but it may have also created a bubble of isolation for physical interaction among their peers. "Since 2010, iGen adolescents have spent more time on new media screen activities and less time on non-screen activities" (Twenge, 2018), which does not require physical interaction nor face to face gatherings. But the same technology that has presented us with the aforementioned isolation, has gotten students more interactive in classrooms at the K-12 education system. This may appear as a contradictory statement on procrastination, but the psychology of the human brain wanting to focus on other 'entertaining' activities than schoolwork has multiple studies that prove the distraction. Many studies have been conducted on the use of technology in the classroom and many parents complain about the excessive time their children spend on their phones and laptops, however the students have no other choice but to access and interact with these devices, since most, if not all assignments and grades are computerized. Our participant observations contain data that prove this dependency on technology. The school itself has an entire floor of the library dedicated to computers for the students' easy access.

It can be noted that through our data we have noticed some dependency on digital devices, but we have at the same time seen that students do not typically want to be so dependent on the devices. While considering such conflicting accounts our research shows how students maintain simultaneous relationships with their technological helpers and the face-to-face interactions. Technology is in fact one of the structures of society that has been designed to meet the social needs of an individual. More than ever, we are able to connect to others in a second whether they are two feet away from us or halfway around the world. Technology has had the power to make instant connection possible. Technology has become one part of society that has helped it evolve and grow and has worked to keep other parts of society functioning together as well.

Literature Review

Searching for articles related to this topic on Google, and academic libraries like JSTOR, Google scholar, and others showed that there has been work done in this area of study, mostly those related to the influence of social media and the large amount of screen time young adults now engage in. While there have not been work specifically related to the California State Polytechnic University Pomona students, as they fall under the categories of students, university and technology, the following works will showcase some of the work used to support the research.

A recurring theme in some of the published works that we found is that technology changes the way that we communicate and changes our sense of "connectedness" (Chayko, 2014). In the article "Techno-Social Life: The Internet, Digital Technology, and Social Connectedness" by Mary Chayko, she describes what it means to be connected in a techno-social world and mentions the fact that technology, social networking, and mobile connectedness has initiated a revolution in today's modern times.

New functions like instant messaging, video calling and even distance calling allows for simultaneous communication with a person from another country without added phone charges given free in apps such as Facebook, Instagram and WhatsApp. The author also argues that digital communication can actually strengthen face-to-face communication instead of having it be detrimental. Our framework for studying and observing technology was inspired by Katie Kilroy-Marac's "A Magical Reorientation of the Modern: Professional Organizers and Thingly Care in Contemporary North America". In it, she explains how professional organizers (PO) try to help those that are struggling with hoarding behavior and material disorder. She argues that some people have a hard time getting rid of their belongings because it causes them great anxiety, distress, and even trauma. Maybe in the same way that these people feel that they cannot part with their belongings, in a similar fashion we sometimes feel that we cannot be without our phones. This is where the theory of human agency comes into play and in this situation, we can raise a question which is, how much agency do we give our phones and/or other technological devices? How much importance do we really give them? Do we have power over them, or do they have power over us?

There were a few pieces of literature which directly related to our research topic. The article by "Mobile technology; Its effect on face to face communication and interpersonal relationships" by Lucas Lengacher was an article that discussed the positive effects of communication. The article explores the idea that technology is a good source for communication when it comes to connecting with family and friends that live far away from us. It is an easy way of connecting to our loved ones and helps improve relationships by promoting the idea of instant communication. But the study also discussed how technology affects face-to-face communication. He focused on texting and voice calls and found that technology used in this way is affecting communication in a negative way, because it decreases communication and intimacy, because of the distance. While there is instant communication, there is a group of the population that prefers interaction with a face to the voice. Having face to face communication is a way to gauge the expression, and bodily behavior of the other person who is involved in the conversation. This article was valuable to our research because it discussed both the positive and the negative ways technology can affect relationships.

The idea of communication between family members is another aspect we read into, the idea of communication is as expected important in today's globalized world, being able to reach one's family members is an idea often marketed. K.M. Hertlein, "Digital Dwelling: Technology in couple and family relationships" is on family relationships and the use of technology within the home. The piece discusses the frequency and easy access to the technological devices within the household. They specifically focus on households with children. This is where most technological devices for leisure are found in large numbers compared to others. Every child will have either a tablet or a gaming device with open access. Another article that expressed interest in how the advances of technology can affect the way people interact with others. Dr. Hertlein and M. Webster, collaborated on the article, "Technology, Relationships, and Problems: A Research Synthesis. Journal of Marital and Family Therapy.". In the article they explain that technology can be a helpful tool for a relationship, but at the same time it can be complicated. Technology can connect families maintain familial relations, connect with each other across the world and even create new

romantic relationships online, some of these stories which we see on the news or trending on twitter.

Technology can negatively impact some of the aspects within the relationship as well. Authors, researchers, and therapists worked with couples and families that were struggling with technology issues. Some of these issues were getting used to being online, being able to use functions such as reactions in zoom or even making international calls through mobile apps like Viber or WhatsApp. As we are exploring students and the impact technology has on their relationships, the idea of family communication was a topic that was also discussed and this type of communication in globalized world was a vital side we wished to understand and apply to our research.

Theoretical Framework

There were 2 theories that we hoped to utilize in our project.

Cultural Materialism Theory

Cultural materialism promotes the idea that infrastructure, consisting of "material realities" such as technological, economic and reproductive (demographic) factors mold and influence the other two aspects of culture. Cultural materialism aims to understand the effects of technological, economic and demographic factors on molding societal structure and superstructure through strictly scientific methods. (Buzney and Marcoux,) Technology then falls in both of these categories as it influences and also shapes culture through its advances. As the Today article mentioned, the tech industry is a "multi-billion-dollar industry" that provides jobs and security to different demographics of people.

Through Cultural materialism we see technology molding to cultures that already exist and creating new cultures through the application of new technological devices and added features.

What some new cultures brought to life? There are so many new types of 'cultures' created in the past decade with the increased usage of internet, social media and new devices. Some of these cultures are pleasant and some are not. They are responsible for the Internet communities and the digital citizenship of the current users. Cultures such as Meme culture and wholesome culture are few types that have popped among social media and other sites, These are positive cultures that make people laugh and feel good about themselves, they also contribute to learning as students use them for certain concepts related to their course. One of my courses uses memes as an assignment and final. It was used to help us understand a concept while remembering what attributes made the concept. Some of the negative cultures that are unavoidable online is "cancel culture", this is considered a very toxic and defamatory form of internet culture. The general idea is to 'cancel' primarily a celebrity/ known figure publicly for immoral behavior such as racism and derogatory remarks regarding another, thereby boycotting them and their products on online social media platforms publicly. This is widely seen in use on Twitter, it originally started with good intentions to let the general public know about the unethical behavior of public figures. But it soon spiraled out of control and led to cyberbullying and harassment as well. These new cultures that have been created through technology and their advancements are a good way of supporting cultural materialism. These cultures have become heavily involved in the structure (politics/economy) and superstructure (religion) roles of cultural materialism.

Actor Network Theory (ANT)

This methodology expresses the idea that humans and inanimate objects can influence and have agency among each other. This methodology supports the idea of cultural materialism and beings forward to the 21st century state of technological advancement and the relationship it has built with the human participants.

ANT is a catalyst to explore the relationship between smart devices and their users. With the growth of the tech- industry, users have also passed some level of agency from their hands over to the device. With shared agency, both humans and inanimate objects are able to influence and shape one another. Cultural materialism theory argues that material objects such as technological, reproductive and economic are the reason that culture is influenced and shaped, but this is wholly through human agency. However, the actor network methodology argues that agency can be shared and distributed among these objects and not only humans can access and exercise agency. The methodology presents support towards the idea that humans can be influenced and directed through smart devices. Inanimate objects being able to sway the decisions of the users is an important point of interest in our study.

How has the agency of technology changed cultures? Technology has widely changed the school and working culture in the past decade. With most schools moving to online systems for assignment submissions, platforms such as Canvas and Blackboard are used as systems of prompt communication with students and courses. It is also important to know that many academic resources are available online to both students and researchers of different fields. Archives such as JSTOR, Wiley and Google Scholar are among the many academic libraries with an online presence. This was not the case in earlier years, as professors have claimed that they have had to comb through multiple physical copies of journals, newspapers, and books to find their related research resources. The ease of using such valuable resources are due to the change in the perspective of technological advancements. Working culture has widely shifted from letters and paper documents to that of online systems as well. Systems such as Google DocuSign and Adobe allow companies to have signed documents with just a click of the share button. These existing cultures have further improved themselves by assimilating to the growth and structure new technology brings.

Actor Network Theory (ANT)

Our project is ethnographic, meaning that we are interested in learning about how students experience their technology and what effects technology might have on their on- and offline social relationships thorough immersing ourselves in their lives. The research methods we employed were participant observation, semi-structured interviews, and an analysis visual material collected by our research team during the study. We carried out participant observation in classrooms, the quad area of the campus, the Marketplace, and the Bronco Student Center. We chose these places because they are the main places for foot traffic. These are the places that most students spend their leisure time together. Another factor we took into consideration was the timing most of our observation took place during the university's U-hour, which means that there is no class taking place and students are most likely to be social. direction of the conversation flow more naturally, helped us build rapport with the interviewee, and thus contributed to the overall validity of our data. The questions were open ended, covering topics such as :

a. Campus friendships.
b. Social media and physical interactions
c. School assignments
d. Balancing family relationships with academics

The people were quite friendly and willing to collaborate with our research. It is a subject that everyone was aware of, so it was not difficult for them to answer the questions. We also collected visuals from campus spaces and campus events. Each student team member took 4 candid pictures for a total of, 20 photos for analysis. After we took each photo, we immediately practiced participant observation about what was going on in the surrounding and the photo itself that we could glean from overhearing conversations and watching body language. We also examined people in groups to see how much they use their technology.

Part of our fieldnotes also include a record of our own habits and device etiquette while in a social setting in a diary. Our analysis of our own behavior with technology to helped draw conclusions about how students felt about their technology's effect on their relationships. For photos, we coded photos, on student body language and the environment they were engaged in. We discussed and coded each situation present in the pictures and was keen on identifying whether the student was using their device as a form of social barrier or not.

Actor Network Theory (ANT)

Our data yielded 4 types of patterns:
1. Students were largely on their cell phones even in social settings.
2. Students expressed thoughts on the "unknown code."
3. Students were able to express themselves more freely only.
4. Students' barrier communication

The use and presence of a cell phone was the most obvious pattern we saw. Students appeared to spend most of their time on their smart phones, this is one of the first moments we see the relationship between students and technology. Most of our photos of students in social settings captured them on their phones. Whether they were walking, sitting, alone, or in a group, these students were focused on the small screen of their cell phone. can be seen in Figures 1.1, 1.3, 1.4, 2.1, 2.3, and 2.4.

Figure 1.1 (Science Laboratory)

Figure 1.1 shows four males sitting on the same bench, yet no one is talking to the other. Three out of the four are on their cell phone, there was no conversation between them. This indicates a moment of social isolation among the subjects of the picture. If we look closely at the picture the student who has their books out and the student next to him appear to be acquaintances, judging by the closeness of the seating, if that is so, they could be interpreted as both social isolation and social interaction. It can be considered social isolation as one person is occupied with both his phone and laptop while the other has no such device in sight. The two students on each end of the bench are very clearly practicing social isolation, their bodies are turned away outward from the two students in the middle. Their body language indicates that they are not associated, our notes also had written evidence that these students [the students at the ends] did not interact with each other nor the students in the middle of the bench during the observation.

Figure 1.3 (BioTrek)

Figure 1.3 shows a small group of three students socializing through face to face interaction, and another student sitting only a few feet away from them, alone, engaged on her cellphone. Here the social interaction is between the three students who are engaged with each other, while the social isolation is shown by the lone female student occupied with her device. There is ample space between the female student and the group of male students, compared to figure 1.1 where there was not much spatial difference between those who were socially interacting and isolating.
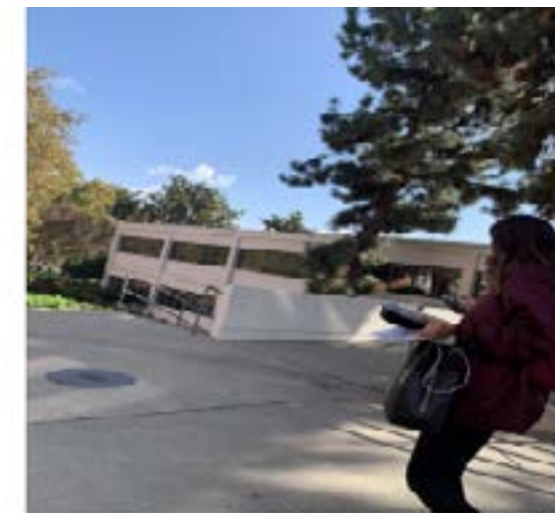
Figure 2.1 (Quad)   Figure 2.3 (Outside of CLASS)

When we see students walking across campus alone and on their cell phone, we are looking at an "unspoken code," in which we all know not to talk to the person that is looking at the screen of their phone, yet no one is told about this, but we all somehow know it. A few of our interviewees expressed this in our conversations. "If I see someone on their phone and I don't know them, then I don't approach them. Like, if they are sitting on their own on their phone or laptop and I need a seat I'll just go there and sit, but I won't talk to them. I will pull out my own phone or computer and just mind my own business. It's like this unspoken rule among people on campus, 'if they are on their phone, don't talk to them, just don't, unless you know, you know them personally. And I like that unwritten rule, students get each other when it comes to this stuff.'" (Interview with student T) This behavior is shown figures 2.1 and 2.3.

Figure 1.2 (College of Agriculture)   Figure 2.2 (Dining Hall)

The second pattern that was present was the use of a laptop regardless of setting. A laptop is an essential tool when being a student in today's time. The use of a laptop is seen in Figures 1.2 and 2.2. It is through a laptop that a student conducts research and completes assignments. Being a student in a technologically advanced world in a university like Cal Poly Pomona, the presence and need for a laptop is high, especially due to the online submission requirement.

From the data that was collected through our research questions, we learned that although most students would like to have one on one conversations with their peers, they find that communicating/ socializing through a screen is much easier than in person.

We also learned that most students find it rude when they are having a conversation with someone and the other person frequently looks at the screen of their phone. However, all students find themselves doing this when others are attempting to have a conversation with them. Students expressed their desire to have face to face conversations, but also affirmed that their busy life did not always allow for such conversations.

During the participant observations, the group members observed that there were people who used their technology to have a conversation topic, by using the devices they could approach conversation through the use of 'trending' issues present in their social media accounts and other online communities.

Some used their devices to work in groups and take advantage of their spare time and finish assignments for school. Others used their devices to spend their time together looking at social media, such as Instagram, Facebook, Twitter, and other online communities they were involved in. In this case these people used their devices as a means of entertainment to keep themselves occupied. There were instances when the whole group would quiet down because the majority of the group would be occupied with their technological devices. They showed others their devices to the other person, then they put their devices down and talked about whatever they have seen or found interesting as a conversation starter. As mentioned before, in these kinds of scenarios, technology helped create topics of conversation.

Then, we observed lonely people, they used their devices to keep track of their schoolwork as well; but when they were not doing school work, they only used social media to spend their free time, or as a means to present themselves as occupied. We have also noted the hybridization of student relationships where they conducted online relationships at the same time as in real life, for example the video games industry's influence was seen through our participant observations or the social media relationships expressed in our interviews. Some of the people that we interviewed expressed the same views about this aspect of digital communication and also agreed that it can strengthen face-to-face communication and connection at the same time.

During the interviews, we received quite a few other intriguing answers, many of them were aided well towards the research however, they were contradictory as well. These answers helped us answer our theories about technology. The majority of the answers were that technology has a big impact on students' lives. Students turn in projects or homework through Blackboard; technology is present in our daily routines. Students and teachers communicate using technology, email, text messages, reminders, etc. Therefore, technology is a great school tool, it can keep students on track of their assignments. Although sometimes, it is the same technology that distracts students from school responsibilities. This was a very common agreement that our interviewees came upon. That while it was a vital tool for school, the time they spent on their devices regardless of school assignments did vary, and some commented on the inevitable path to procrastinate and as a tool of distraction.

"90% of US young adults with internet access use social media" (Villanti, 2016), this number can only go upwards with the current pandemic. Through our research we noted that there are many conflicting opinions on the use of technology among students. Students view technology as both a good and a bad. They understand the detrimental effects of being exposed to the ease that new technologies bring. They have also understood the importance of having a face-to-face conversation, which they admit is hard to accomplish with devices are within hands reach. The students give out contradicting answers; they conducted their own self observations, evaluations and listened to others with same opinion and come to the hypothesis that is hard to hold a conversation without the need to reach for the smart devices. Nevertheless, they also agree that these devices have helped them assimilate into school settings faster, make connections more sustainable through the use of social media and as a form of psychological relaxation.

Analysis/Discussion

Technology affected students' relationships in both positive and negative ways. The students admitted to both focusing on their devices and hoping for face-to-face communication. Thus, technology was seen as a double-edged sword it is a helpful tool for our daily life activities, but at the same time students explain that it distracts them from the important aspects of life. As the investigation progressed, we realized that our theory was valid and could be applied in different ways. But what we decided was to discuss it in the simplest forms possible.

Social Interaction

The students expressed the ease of technology and the ability to complete their assignments at any time because of their laptops and free access to college computers and assignments at any time. They are able to connect with their peers momentarily for group projects and printing services. They are able to connect with their peers momentarily for group projects and scour the web for research material. "Mobile phone communication positively influences social relationships of adolescents who have shown they are more capable of reconciling their activities both offline and online networks, for example, when they communicate with certain frequency via mobile, while at the same time maintaining the same or more contact with friends offline. This also occurs when the group of friends using these resources includes people from other schools, neighborhoods, or cities, which permits greater diversity. Interactions online and relationships outside the internet complement each other as long as they do not yield a disequilibrium that negatively impacts social relationships." (Vidales-Bolaños, 2017). The form of interaction among the CPP students, who were observed in groups appeared to relate well in this manner, their online relationships was compromised with the same group of friends offline as well. While it appears to seem that that most of the students who are able to have such a balance appeared to be students who identified themselves as extroverts. However, through personal experience and observation, close and small friend groups appear to exhibit the same balance as the students with the vibrant personalities. They are able to interact in both face-to-face interactions plus online interactions. "Although digital communication does favor brief, frequent contacts, it does not destroy the value put on social associations or discourage people's willingness to communicate deeply in-person. In fact, the evidence suggests that it more likely facilitates both, at least amongst that portion of the population that functions typically" (Zilbertstein, 2015). Including some of the literature we have read there is no solid answer as to if "we cannot tell communication does not lead to closeness when people are communicating electronically" (Cummings, 2002).

Social Isolation

There are many students who are introverted, that excel in the online communities. "Anonymity gives teens the space and opportunity to discuss embarrassing topics, teens and youth engaged in chat rooms often show support and sensitivity to each other, which includes allowing free expressions of feelings (Subrahmanyam et al. 2004)" (Vidales-Bolaños, 2017) It would not be wrong to assume that college students have the same mentality, they are free to express themselves and have a topic of conversation available to them through the use of technology. Speaking from both personal experience and the analyzing the data we have collected, using the phone and the laptop as a social barrier

helps control the interactions between people and maintain a calm mind, than fear a sudden approach to join a club or support a cause advertised on campus. "Computer usage lacks the nonverbal and environmental cues that are present in face-to-face communication, which makes one feel less burdened when interacting with others in an online context rather than a face-to-face interaction (Munoz, 2013)." (Lengacher, 2016). If students are able to freely express their ideas and thoughts without the fear of judgement, then they would not fear participating in classes which would increase class performance.

Limitations

This research began as a class assignment to experience how an actal research project would happen. Throughout the process of getting started, constructing questions, going out and gathering research, then analyzing what we had found, there were things we learned that worked and did not work. One of the things we would seek to improve in the future would be our questions and the size of our sample group. As we learned from our anthropological methods course, any question can be changed and molded into a stronger, more precise question. We would seek to improve our questions in order to make them more detail oriented and focus driven to understand what being a Cal Poly student in the age of technology is like. By asking our questions with specific themes and categorization, we will be able to get our interviewees to think differently, and possibly bring up a new topic that was not brought up with the initial questions we used. In order to expand on this research topic, we would also like to expand the targeted population and not only focus on students across CPP campus. This type of research would be helpful in understanding today's students and their interaction with others through technology because research on the effects of technology on social connectedness among students has not been studied. This is because technology intertwined with sociology is a fairly new topic. We believe that as technology continues to grow, our need for it will grow as well and our way of interacting with technology and others will continue to change. Further research done on this topic can help track that change.

As to where this study might lead further to is to look into the psychology behind why people hide behind their devices. We research how our devices can create a way to disrupt our relationships, but how does it also enhance a relationships core values? It would be fascinating to explore the mindset between the two sets of population to understand their psychological response towards technology and cultivating relationships. What other outside factors are there to pursue? Perhaps a dive into the individual's past. We can further the study by looking into whether these people saw themselves as introverts or extroverts. We feel that this study should be paired better with the study of oneself.

COVID-19 Disclaimer

This projected was carried out on Fall 2019 before the global pandemic began. However, the sudden migration and academic year online has contributed several insights to this project, that will be compelling avenue for the future of this study.

With the current Covid-19 pandemic, many schools are conducting classes online, including CPP. From personal experiences some professors do not require students to have their camera on during class and this has been positive to class participation. Therefore, while it may appear that social isolation may be caused by technology and new software, the academic participation of students has increased, which also contributes to maintaining

social relationships and cultural materialism theory.

Students are able to interact with the peers they would not normally reach out to if they were in a traditional classroom setting, by allowing them to adapt a space that compromises the needs of the two different types of students by socializing through the use of devices during a class. Technology (infrastructure) has then influenced the classroom (structure) by utilizing a remote space and in turn contributed to the productivity(superstructure) of the students.

Conclusion

In conclusion, the way students interacted with our technological devices does w they build their social relationships. From what we have seen in our research, students act a certain way with their devices in different situations. The most common situations in which people used their device was to be doing homework or to be on some sort of social media platform, with the most common device being on the phone.

How has the abilities to make social relationships changed since the introduction of technology in our lives? The simple answer is that we have adapted and evolved with our technology. Has it made it harder to keep the attention to someone while in a conversation? 20 years ago, this might have been the case. But now that many of us have grown up with these devices as an everyday part of our lives, this has changed. Students are now forced to possess more multitasking capabilities, so that are able to talk and text at the same time. Students try to be productive with homework and carry on a conversation with our friends at a study group on their laptops, which may seem rude to your companion. Students have adapted to use the devices to the best of their abilities to be an advantage, with their multiple functions and software. Just because they now have devices to distract them from real life, what about making one in a virtual life? Devices are just another mask that people can wear to get by in this day and age. Therefore, to blame the devices for hurting our social relationships is just an easier way to push off the fact that our society and its growth has led us to become dependent on our devices. There is a definite change in manner we communicate, but it is more of an adaptation to technology as mentioned in the Today article, which claimed that technology was now a heavily lucrative industry with a permeant space in human lives. The further into the 21st century we move, the more we can expect different types of new devices to be released and adapted. Who knows how different social relationships and technology will be in the next decade and how that may influence our way of communication?

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Using consumer feedback to determine the most desirable attributes of food product enriched with orange pomace

Abstract

Orange pomace is mostly the peel of the oranges that remain after industrial juicing. The orange pomace that is discarded is a rich source of polyphenols. Polyphenols have shown to exert antioxidant, anti-cancerous, and inflammatory properties. Besides the many benefits to human health of using fruit pomace, it also to alleviate the waste in an industrial setting. The goal of this research is to conceptualize a functional food product that incorporates orange pomace and research what characteristics of the product would most likely determine success in the market as a functional food. Conjoint analysis software brings opportunity to understand preferences and what they value for as a product. The survey was given to 150 participants sets up 3 products with different characteristics described. The products differ in flavor, health claim, texture, type of day item, and convenience The results have shown that the consumer's driving choice is for an item that is sweet, crunchy, and ready to eat it being also high in fiber, eaten at room temp or cold over breakfast or as a snack. Also, 59% of consumers did not show a preference for a product that is plant based. After the conjoint analysis data is examined another consumer survey will be used to determine the liking and preference of the two further developed product concepts. Future research is envisioned to make these products and do a sensory evaluation.\

Keywords: Orange pomace, functional food, orange polyphenols, polyphenols

Introduction

With the rising importance of active and healthy parallel, there has been an increase in eating superfoods. Fruits have been found to be healthy with antioxidant activity. The outer layer known as the pomace of fruits has been found to be richer in polyphenols that have biological activity and modulate metabolic processes promoting better health (Sir Elkhatim, Elagib, & Hassan, 2018). There are many benefits to using fruit pomace not only to human health but also to reduce food waste in an industrial setting. As an example, over 6 million tons of citrus were produced in the United States from 2016-2017 (Babcock). California contributes over a third of that production (NASS/USDA, 2020). The U.S. orange juice companies produce about 330,000 tons of juice concentrate this year (Cornell & USDA, 2020). However, the Citrus industry uses only about 1/3 of the weight of the orange to make orange juice, meaning that more than half the orange goes to waste (Rafiq et al., 2016). Consequently, food waste from the orange industry is a huge concern here in the US. The orange pomace that is discarded is a rich source of polyphenols. Polyphenols are plant-origin compounds that have antioxidant activities. Orange pomace polyphenols are known to have anti-cancer, antiviral, and anti-inflammatory properties (Hu, Kou, Chen, Li, & Zhou, 2019,).

Functional foods are a specific type of food that exerts a beneficial effect on human health besides their nurturing properties. It can range from having vitamins, minerals, antioxidants, probiotics., etc. It is anything added to a food with a specific added heath functionality. (Hut, 2016). Functional foods have more specific and targeted nutritional value

for physiological function than others. (Rincón-León, 2003). Having clean label ingredients, an ingredient list that is not too long, and not having additives that are unknown, is important for consumers. In fact, 73 % of consumers will happily pay a higher price if they recognize ingredients that are known to them and feel safe eating. (Bizzozero, 2020) Having functional ingredients that are recognizable by consumers is therefore very important. By using orange pomace, you can incorporate polyphenols with strong anti-inflammatory and antioxidant properties such as hesperidin or naringin to create functional foods.

Food companies, manufacturers, retailers, and other similar food service organizations rely heavily on food trends. These food trends are an important tool used for businesses. Understanding these trends and creating a product from data plays an essential role in creating successful food products that will stay in the market and generate good revenue. The conjoint analysis brings together an opportunity to understand customers' preferences and what they value as a product. This is a method of research that creates simulations through collecting and analyzing surveys. This information helps highlight product features that people like. Conjoint analysis works by breaking down a product into different attributes which are a product's features/characteristics. The method creates a survey and asks respondents to choose between potential products to be released that are being compared by other products side by side with the chosen attributes. The program software is then able to calculate preference scores which are determined by what attributes of a product concept are preferred. (Conjoint.ly)

Goal

The goal of this research is to conceptualize a functional food product that incorporates orange pomace and research what characteristics of the product would most likely determine success in the market as a functional food using conjoint analysis.

Methodology

The protocol of this project has been approved by IRB#20-154. The survey/conjoint analysis software used was Conjointly. The invitation to take the survey was shared via Instagram, Facebook, Linkedin, it was also announced in school club/class zoom meetings. The link took you to welcome page that included the consent form. Then it provided a summary of the benefits of orange pomace and the goals of the research project. On the next page participants were asked to picture a product that contained orange pomace, choosing between the product being vegan, vegetarian, or plant based. A conjoint analysis was then conducted using the variables described below and surveying at least 150 participants, we asked them to choose between potential products to be released that are being compared by other products side by side with the chosen attributes. From three product options they were to choose one. Conjointly uses different concepts combining these attributes, asking the participants to select between the created concepts. There was a total of 8 pages each containing three products with alterations based on the characteristics. Based on the participant responses, the software highlights what attributes are the most relevant to consumers.

The attributes were grouped in six categories:
- Type of day item: breakfast, lunch, or snack.
- Temperature: hot food, room temperature, cold item.
- Flavor: sweet, savory, or sour product.
- Nutritional claim: high protein, high fiber, or low in fat.

• Texture: crunchy, chewy, or liquid product.
• Convenience: ready-to-eat product, cooking required, or microwavable.

For relative importance conjointly uses Pathworth utilities in form of conjoint analysis by which numerical scores where measure to determine how much each feature influenced the participant in making the choice. Conjointly also formulate a table with ranked list of product concepts preferred by consumers. The first two being the most useful concept ideas. While descending to ideas the last being the worst product concept possible.

Results

A total of 150 participants answered the survey. Chart 1 shows that 59% chose a product that was neither vegan nor vegetarian. This shows that 41% of people would prefer to stay away from animal-based products, with 13% showing they would prefer vegan. This makes sense there has been study's showing an increase in people choosing more vegetarian and vegan diets. There has been a 40% increase in Americans who are incorporating more plant-based meals in their diet. In 2017, it was a 3.9 billion market in dollar sales last year it increased 29% into a 5.0 billion market (The Food Industry Association & IRI, 2018).Figure 1 in the appendix shows that flavor and texture and convenience are the most influential aspects for consumers to choose a product. On the contrary, the least important attribute was the type of day (breakfast, lunch, or snack). This coincides with an article published by Food Technology Magazine, Snacking and ready to eat more convenient foods is a prominent trend. This is predominately true for Gen Z generation. Although they are more likely to snack Gen Z gens are more health conscious, have higher nutritional standers, and would more likely be vegetarian. (IFT, 2019) Figure 2 shows in more detail the highlights of each attribute. For example, flavor when comparing sweet, sour, and savory the results show that savory almost along with sweet was the most preferred flavor while sour was the least liked flavor. Respondents disliked liquid products. They favored crunchy over chewy textures. Convenience was a decisive factor as well. Ready to eat products were important as cooking and microwaving were on the negative side of the scale. Consumers didn't pay much attention to health claims, type of day items, or temperatures of the food in their decisionmaking. But what was highlighted being a snack product that was high in fiber was important. Also, a cold snack was the more desired type of food item over room temperature and hot. Table 1 shows a ranked list of product concepts preferred by consumers. The first two being the most useful concept ideas and the last one being the worst idea combinations of attribute that most likely will fail. Note that the list was shortened to highlight the top two and last two combination of attributes out of 486 combinations.

Conclusions

The information provided by the conjoint analysis helps eliminate possible ideas that might fail, becoming a useful tool to conceptualize products based on these characteristics. Knowing the two top list of product concepts generated where one a product that is savory, crunchy, high in fiber, cold, ready to eat snack and the second a sweet item that's crunchy, high in fiber, cold, ready to eat snack. With those these attributes in mind, two product ideas could be an orange pomace savory gelato and orange pomace sweet gelatos both with wholegrain/orange pomace infused high fiber delicious edible cups are two possible formulations of a product that would most likely succeed. This not only saves time for a company but can reduce food waste, energy, and natural resources from creating unsuccessful products.

Appendix
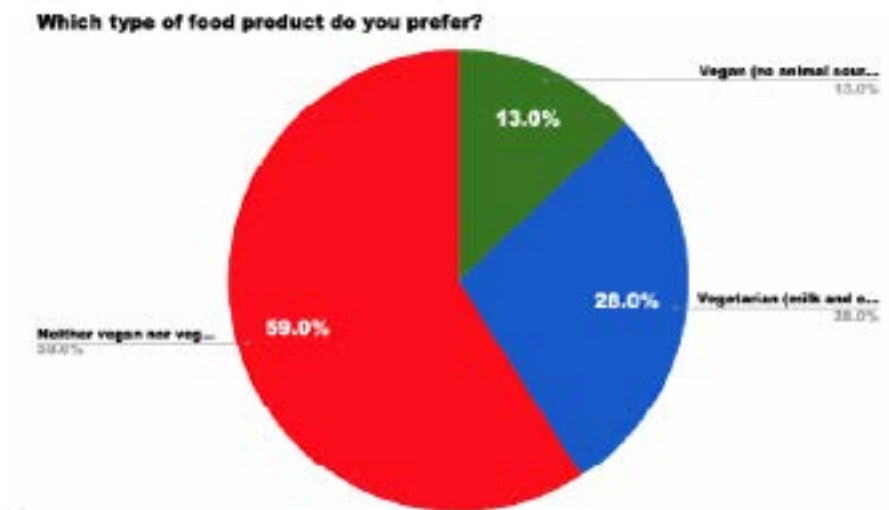
Chart 1. Survey on diet choice.
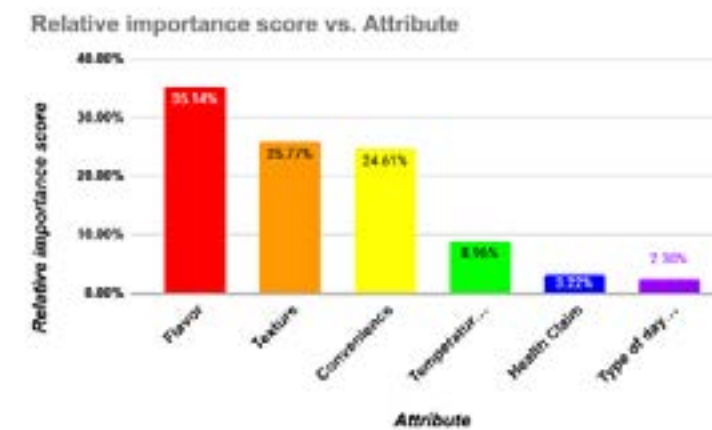
Figure 1. Relative importance by attributes.
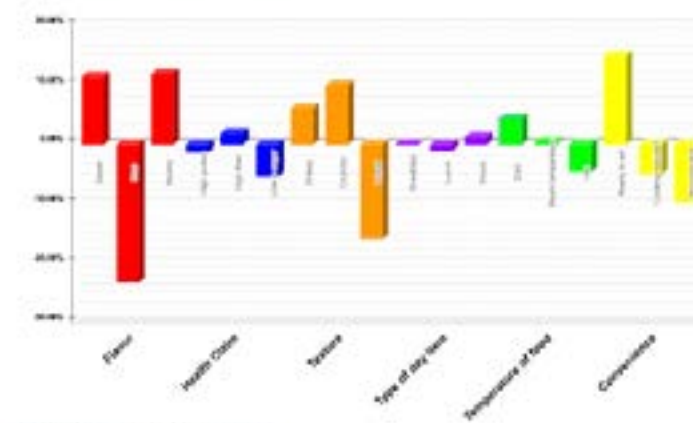
Figure 2. Relative importance by level.

Table 1(ranked list of product concepts as preferred by customers)

◇ Flavor	◇ Health Claim	◇ Texture	◇ Type of dav Item	◇ Temperature of food	◇ Convenience	Value of customers	Rank
Savory	High fiber	Crunchy	Snack	Cold	Ready to eat	44	1
Sweet	High fiber	Crunchy	Snack	Cold	Ready to eat	44	2
Sour	Low in sugar	Liquid	Lunch	Hot	Microwavable	55	485
Sour	High protein	Liquid	Lunch	Hot	Microwavable	55	486

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Gregorio   **Emotional Memory Encoding**
Audriana

Abstract

　　Emotions have a powerful influences on memory formation. We know that aspects of memory, including how and where in the brain they are formed, can differ depending on the valence of the stimuli. It is theorized that emotional events and experiences tend to be remembered with greater clarity and detail in comparison to unemotional events and experiences. Over the past decade there has been a growing interest in understanding the brain mechanisms associated with the formation of emotional memories. When emotionally arousing stimuli are encountered, the interpretation and significance of that emotional experience influences the neural activity and interactions of different memory regions within in brain. Research studies using fMRI data have been used to identify the neural correlates of emotional memory encoding. The majority of these fMRI studies have provided evidence that there is consistent functional interactions between the amygdala and prefrontal medial temporal lobe structures, which includes the hippocampus. These two systems appear to be responsible for the formation and storage of emotional memories. This meta-analysis aims to identify how emotion influences memory encoding and consolidation, and the brain regions that are associated with emotional memory formation. It also aims to distinguish the contributions of each identified region and structure. It is anticipated that this research and future research of emotional memory could provide insight regarding the neural structures that regulate emotions, which could provide more effective strategies for psychological interventions and treatments.

Objective

　　This research project is designed to gain an understanding of why emotional events and experiences seem to be remembered more vividly and with greater detail than neutral events. To answer this question I will need to know how emotional memory is encoded into the brain, by first identifying the brain regions most associated with emotional memory enhancements during encoding, and secondly by examining the functional interactions amongst these brain regions.

Hypothesis

　　It is predicted that emotionally arousing stimuli will be remembered and recalled with greater clarity and accuracy than neutral stimuli, and that neuroimaging will provide the ability to identify the different brain regions that are associated with emotional memory encoding.   It is hypothesized that the amygdala, hippocampus, areas of the para-hippocampal gyrus and areas of the prefrontal cortex (PFC) will be distinct regions that support successful emotional memory formation. It is also hypothesized that these brain regions will form a functional core network and that they will be the center of networks, compared to other regions and they will have a different community structure. Additionally, it is predicted that the Amygdala will be the strongest predictor of memory of emotional stimuli versus neutral stimuli; and, it will be the center of networks showing the highest degree of centrality, compared to other regions.

Method

The method for conducting this research was done by using meta analytic functional connectivity mapping. Functional connectivity mapping allowed for the examination in the patterns of co-activation.

The first step to accomplish this method was to complete a literature search of peer reviewed journals and articles on the emotional subsequent memory effect. This search was done using the Cal Poly Pomona University library online database. The articles selected had to include studies that used functional magnetic resonance imaging (fMRI) data that compared brain activity during encoding and retrieval of neutral and emotionally arousing stimuli. They also needed to include identification of specific brain regions and Talairach coordinates. The search was conducted using the Cal Poly Pomona University library online database. Key words used to search for articles were (1) emotion, (2) memory, (3) encoding, and (4) fMRI. 24 peer reviewed journal articles were selected to be used in the meta analysis. Activation Likelihood Estimates (ALE) will be used to identify regions that show greater encoding success activity for emotional versus non-emotional or neutral encoding. Finally, graph-theory metrics and community-detection algorithms will be applied to investigate network structures.

Literature Review

　　Current research has revealed that emotional stimuli are remembered more vividly than neutral stimuli. This may be due to the fact that arousal from emotional stimuli triggers changes in brain activity that influence cognitive and mnemonic processing. A great number of cognitive neuroscientific studies have examined the neural basis for this "emotional enhancement" of memory. This research suggests significant emotional memory enhancements when memories are encoded during an emotionally aroused state (Ritchey, LaBar & Cabeza, 2010). This type of research is important because it can provide insight for understanding the mechanisms and brain regions associated with the development of traumatic memories in PTSD.

　　Research suggests that there are specific brain structures that are engaged with the processing of emotional information; and that these structures are responsible for successful detailed encoding (Murty, Ritchey, Adcock, & LaBar, 2010). These studies on emotional memory encoding have been able to identify the brain regions in which increased activity during encoding had successfully predicted the accuracy of the retrieval of emotional memories (Hamann, 2001). This has been accomplished by conducting fMRI studies, which have been used to compare brain activity during both the encoding and retrieval of emotional and neutral stimuli. Consistent activations have been identified in both the left and right amygdala and the anterior hippocampus during emotional memory encoding (Murty, et al, 2010). These findings suggest that the amygdala has an imperative role in mediating emotional memory enhancements. Functional magnetic resonance imaging (fMRI) has provided evidence that emotional processing during memory encoding is associated with increased activation of and functional interactions between, the amygdala and the hippocampus, as well as other key medial temporal lobe structures that support emotion and memory processing (Murty, Ritchey, Adcock, & LaBar, 2010).

　　Although much of the research on emotional memory encoding focuses on amygdala and hippocampal interactions, it is important to recognize other regions that influence the formation of emotional memories. Brain regions such as the inferior parietal lobule, the middle occipital gyrus and the parahippocampal gyrus are associated with sensory processing and visual attention (Mickley, Steinmetz & Kensinger, 2009). Literature indicates that emotional arousal impacts visual processing, resulting in a more detailed perceptual

analysis of an emotional item, therefore improving the quality of the information being sent to memory systems (Mickley, Steinmetz & Kensinger, 2009) These brain structures may help to enhance attention and sensory processing, therefore strengthening the memory for emotionally arousing items. Researchers have used a variety of methods to investigate and study emotional versus neutral memory. These fMRI studies have provided insight on neural patterns and have helped to identify specific brain networks associated emotional memory formation. Consistent interactions between the amygdala and prefrontal medial temporal lobe structures appear to play a key role in the successful encoding and storage of emotional memories. Additionally, structures responsible for visual attention appear to improve encoding and enhance memory detail. This meta-analysis will aim to provide further validation of these prior research findings, and to gain a better understanding of how encoding and consolidation contribute to memory of emotionally arousing stimuli.

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How Mindfulness Meditation Impacts Long-Term Explicit Semantic Memory

Abstract

    In light of the Coronavirus-19 Pandemic inflicting the world, college students in the United State of America are concerned about their health, the state of the economy, and dramatic lifestyle shifts, and they are experiencing an increased level of stress (Copeland et al., 2020). Stress takes a toll on our cognitive function, which can negatively impact our abilities to store information. Studies have shown that both music and the practice of mindfulness meditation strengthens brain function, which helps to enhance memory (Ferreri et al., 2013; Roozendaal et al., 2009). The current experimental study aimed to provide insight to pinpoint the benefits of how a single meditation along with music could improve memory recall, and their ability to aid one's cognitive abilities to remember words that are attempted to be stored in memory semantically. Participants were majority female 84.7%, Hispanic or LaxinX 42.4%, between the ages of 18 and 25 83.9%, and at or below poverty level 61.1%. It was expected that participants who listened to background music during encoding and recall as well as engaged in a mindfulness meditation would remember the most words. There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music F(3)=1.47, P>.05. Additional data collection, or a larger and more generalizable sample, would be necessary to increase the power of this study. This should not discount the individual benefits that both mindfulness meditations and music have independently shown in the past.

    Key words: mindfulness, meditation, memory, recall, music, semantic memory, relaxation, body relaxation, body scans, mindfulness meditation,

    In light of the recent outbreak of the Coronavirus Disease 2019 (COVID-19) that has impacted the world, there has been growing discussion about escalated rates of stress. In the United States of America (USA) college students are concerned about their health, health care, the state of the economy, and dramatic lifestyle shifts. Collectively, college students are experiencing increased levels of stress; and, prolonged stress takes a toll on our cognitive function, which can negatively impact our abilities to store and retain information (Conrad, 2011). It is possible that the consequence of this collective trauma could lead to a decrease in the ability to process and store new information in our brains. Fortunately, studies have shown that both music and the practice of mindfulness meditation strengthens brain function, which helps to enhance memory (Ferreri et al., 2013; Roozendaal et al., 2009).

Stress and Memory

    Stress is a very useful adaptive phenomenon because it initiates an efficient physiological response to threatening situations. When the body becomes stressed, it can be useful in recalling memories almost automatically as a protective response. For example, when a person touches a hot surface, the brain remembers that heat causes pain, and therefore the person will usually move their hand away before they consciously think about being burned. However, prolonged stress can actually hinder memory. The prolonged social isolation, economic instability, and political chaos that we are currently experiencing, has created a heightened state of stress for the majority of the U.S. population. Psychobiologists say that prolonged stress can trigger an overproduction of hormones that actually change

the structure of the amygdala and hippocampus, due to high levels of adrenaline, which can block memory enhancing neurotransmitters (Liang et al., 1986). This type of prolonged stress can lead to a decrease in the ability to encode new information.

Mindfulness And Memory

For over 2,500 years Buddhists have claimed that practicing mindfulness reduces suffering. Over centuries, mindfulness has evolved from a spiritual practice to a prevalent and secular health care intervention used to not only reduce pain and stress, but overall improve well-being and quality of life. Mindfulness has been defined as the awareness that emerges through purposely paying attention to the present, and nonjudgmentally unfolding one's experience from moment to moment (Kabat-Zinn, 2003). Like other natural baseline abilities, mindfulness can be modified and enhanced to reduce stress and improve quality of life (Kerr et al., 2011). Mindfulness meditation helps to decrease stress by returning the body into a state of homeostasis, which then increases brain function. Improving one's cognitive flexibility will subsequently reduce fatigue, especially during continuous exposure to stress-inducing scenarios; and, it will ultimately yield beneficial outcomes associated with cognitive functioning. One of the main physiological and psychological benefits of mindfulness is associated with reduced anxiety and stress, specifically in conditions that involve anxiety, depression, neuroticism, rumination, and distress contagions (Bergen-cico et al., 2013). Depending on an individual's needs, mindfulness has evidently demonstrated its potential as a natural buffer that can mitigate one's negative reactions to everyday stressors.

Mindfulness meditation is a form of clinical practice supported by evidence-based research for its efficacy in treating various physical and psychological conditions (Ramel et al., 2004). Typical mindfulness meditation practices could be performed in a variety of ways. In this modern era, guided audios are designed by Certified Mindfulness Practitioners. These guided audios consist of directed deep breathing exercises, body scans, and depending on the goal of the meditation, targeted language to enhance the experience. Various forms of meditation are taught, including seated meditations, where participants incorporate other foci such as breathing and thought exercises. Regardless of the type of mediation, mindfulness meditation requires great focus and challenges one's cognitive efforts against typical intrusive thoughts and emotions; therefore, it may be difficult to successfully execute at the beginning. During body scans, participants are instructed to focus their non-judgmental attention on sensations experienced through different areas of their bodies. This is supported by comparative observations on the increase of self-awareness due to the decrease of rumination. Mindfulness meditation is geared towards relieving oneself from psychological and, in many clinical cases, physiological burdens. This is done by employing a similar focus used during body scans, where individuals focus on certain sensations, such as breathing, pulse rate, and other bodily functions while negating distractors (e.g., thoughts, sounds, surroundings, etc.).

Since mindfulness practice originated from Buddhism, there has been ongoing debate between religious or spiritual text and the academic community about whether or not mindfulness can improve memory. A comprehensive literature review was conducted on stress that emphasized that reducing the amount of adrenaline in the brain allows for more neurons to fire on the pathways between the amygdala and the hippocampus (Roozendaal et al., 2009). Clinical settings for psychotic patients have implemented 45-60 minute

classes consisting of gentle movements and mindfulness practices that have significantly reduced the physiological response associated with levels of adrenaline in the brain (Russell & Arcuri, 2015). Since mindfulness practices can reduce adrenal levels in the brain pathways between the amygdala and hippocampus, cognition could be strengthened, which could improve emotional processing and memory.

The practice of mindful meditation has become increasingly popular because of the many benefits that it can have on the body, including brain function and one's ability to focus. Some research has been done on the cognitive effects of mindfulness, and the relationship between mediation practice and memory enhancement. Studies have indicated that frequent meditation practices help to strengthen and increase function in the cerebral cortex and hippocampus, two areas of the brain that play a key role in attention, perception, learning and memory (Tang, Holzel & Posner, 2015). Through neuroimaging, it has been observed that there are significant improvements on brain regions that are associated with attention, introspection, and affective processing, all of which are associated with how the brain processes memories (Tang, Holzel & Posner, 2015). Mindfulness has become such an effective technique used to train your mind to improve your physiological state.

Mindfulness Based Stress Reduction (MBSR) programs that consist of 8 to 10 week long retreats, including daily mindfulness activities and self-directed mindfulness practices, have shown statistically significant reductions in stress and the improvement of cognitive functioning (Bergen-cico et al., 2013). These elongated mindfulness immersion programs have improved the lives and cognitive abilities of people with stress disorders. Individuals who completed such programs returned to their regularly scheduled lives refreshed, and with many of the cognitive abilities (such as focus and memorization) that they had lost. The reason why MBSR programs were developed is because mindfulness practice requires a learning curve; therefore, enhanced benefits are shown overtime.

Music And Memory

People are exposed to background music regularly in their daily lives. Background music is often playing in restaurants, stores, and waiting rooms; and, most people have music playing while they are driving or just doing chores at home. Music is so powerful that it can influence our moods and emotions. For example, the movies and television shows we watch use background music to help set the mood and enhance the viewers experience. It is evident that music enhances our lives in many ways. In recent decades, scientific research has explored the impact music has on one's mental state and cognitive performance. It has now been suggested that music can aid in learning and even enhance memory.

Previous research studies have shown that music presented during the encoding process has a positive impact on memory during memorization and recall tasks, which is most likely due to the fact that auditory stimulation deactivates the prefrontal lateral cortex (Ferreri et al., 2013). Thus, it provides richer contact for encoding because there is less demand on the prefrontal lateral cortex (Ferreri et al., 2013). Later research supported previous findings that music aids in verbal encoding in order adults (Ferreri et al., 2014). These findings suggest that music affects the brain's neurocognitive state by calming down brain activity, therefore increasing its capacity to process and encode new information (Ferreri et al., 2014).

One thing we need to consider in this type of research is the genre of music being listened to, as well as the tone and tempo. It has been suggested that fast, up beat music with vocals could have a negative effect on learning and recall, compared to calming instrumental music (Cassidy & MacDonald, 2007). Some research has indicated that listening to popular music with vocals actually decreases performance in memory recall tasks, suggesting that certain types of music may be too distracting and can impair learning and memory encoding (Cassidy & MacDonald, 2007). It was also found that calming music significantly improved cognitive function and performance during memory tasks (Cassidy & MacDonald, 2007). Research still has yet to determine, however, if music affects cognitive function directly; or, if arousal and change in mood are directly responsible for these cognitive enhancements. This is a topic that should be explored.

Background music increases the activity of neural mechanisms that are responsible for focus and attention. In the field of Cognitive Science there is much research to support that music helps to improve memory and focus. Functional near-infrared spectroscopy (fNIRS) has been used in past studies to measure and record the difference in brain activity during encoding and memory recall. An experimental study that was conducted on older adults in their sixties, took fNRIS neuroimaging measurements while participants were asked to complete encoding and retrieval tasks by being presented with a list words while either listening to music or in silence; and, this study concluded that there was a higher recollection of words for participants who were in the music condition (Ferreri et al., 2013). This research suggests that stimulating the dorsolateral prefrontal context during encoding and recall tasks causes a positive level of arousal that improves memory (Ferreri et al., 2013).

Current Study

Mindfulness meditation is stated to be a practice that should be learned over time. Since there is little research on the effects of a single mindfulness meditation, we were interested in how a single mindfulness meditation might impact the conscious mind's ability to encode and consolidate information into long term memory using semantic representations and a musical aid. This intervention could provide an innate tool that is free and can be practiced from anywhere in the world. Therefore, this current study will be instructing participants to attempt to encode a list of words into their long term memory using semantic cues, by mentally visualizing a word list. Our research aimed to provide additional information to pinpoint the benefits that a single mediation might have on memory recall, in order to understand the full range of effects mindfulness can have in daily life.

Purpose

Based on the plethora of knowledge provided by the experts from various fields, the current study aims to provide evidence that two simple leisure activities can improve memory while simultaneously reducing stress and improving cognitive functioning. It was hypothesized that participants who completed the mindfulness meditation task would recall more words than those who participated in the distraction task. It was also hypothesized that participants who listen to background music during word memorization and recall tasks would recall more words than those who did not listen to background music. Finally, it was hypothesized that participants who listen to background music during the word memorization and recall tasks, in addition to completing the mindfulness meditation task, would recall significantly more words than participants in other conditions.

Variables

The independent variables in this experiment were meditation and music. The meditation variable consisted of two levels, either with meditation or with no meditation (which consisted of a distraction task). The meditation was operationally defined as a 10 minute, prerecorded, guided meditation consisting of breathing exercises, body scans, body relaxation techniques, and practicing self-compassion. The distraction task was operationally defined as a 10 minute, implicit association test (IAT), that tested instant positive or negative associations for insects or flowers. The music variable also consisted of two levels, which were either with background music or with no background music. The music was operationally defined as a 3 minute and 30 second instrumental acoustic jazz piece, titled "If you see my mother" by Sidney Bechet. Condition 1 consisted of both the mindfulness meditation and background music. Condition 2 consisted of the mindfulness meditation and no background music. Condition 3 consisted of both the distraction IAT and background music. Condition 4 consisted of both the distraction IAT and no background music. The dependent variable in the experiment was the number of correct words that were recalled within a time span of 3 minutes and 30 seconds.

Method

Participants

Participants were students recruited from California State Polytechnic University, Pomona, Psychology Department, and who were currently students attending a traditionally face-to-face institution that was converted to an online format as a COVID19 safety precaution. The students took the online experiment for course credit. Participants were majority female (n=50) at 84.7%, between the ages of 18 to 25 (n=24) at 84.5%, Hispanic or LaxinX (n=25) at 42.4%, and at or below poverty level. The following tables include a full breakdown of the demographic information of the participants that was collected. Participants reported gender (n=59) was 15.3% male and 84.9% female. Participants reported ages (n=58) were 41.4% 18-21, 42.5% 22 to 25, 6.8% 26 to 29, 5.1% 30 to 32, 1.7% 33 to 36, and 1.7% 40+. Participant's reported race/ethnic identities (n=59) were 18.6% White, 5.1% Black or African American, 5.1% American Indian or Alaska Native, 15.3% Asian, 1.7% Native Hawaiian or Pacific Islander, 42.4% Hispanic or LatinX, 3.4% Middle Eastern, 6.8% Multi-Racial, and 1.7% French. Participant's reported household income level was 15.3% less than $10,000, 10.2% between $10,000 and $19,999, 22.0% between $20,000 and $29,999, 13.6% between $30,000 and $39,999, 8.5% between $40,000 and $49,999, 5.1% between $50,000 and $59,999, 6.8% between $60,000 and $69,999, 3.4% between $70,000 and $79,999, 1.7% between $80,000 and $89,999, 5.1% between $90,000 and $99,999, 3.4% between $100,000 and 149,999, and 5.1% at $150,000 or more.

Materials

Guided Meditation Selection

The mindfulness meditation that was selected for the current study was designed by a Certified Mindfulness Practitioner, Alane Daugherty, Ph.D.; who, is a full-time professor and Stress Management expert at California State University, Pomona. The mindfulness meditation was a 10-minute long pre-recorded guided audio that instructed the participant to close their eyes, be aware of their breathing, engage in a relaxation and practice self-compassion. The link to the guided meditation link is as follows:

https://drive.google.com/file/d/13cluXXjAB_Ub7uoI4l8537aboAFfF2Lq/view?usp=sharing

Music Selection

The condition with music consisted of an acoustic instrumental jazz piece titled "If you see my mother (Si tu vois ma mère)", by Sidney Bechet. The length of the musical piece was 3 minutes and 30 seconds. This music selection had successfully been used in prior research studies, and was applied to this study (Ferreri et al., 2013, 2014). The link to the music selection is the following: https://youtu.be/WNdzbdSpf9I

Word List Selection

The word list was made up of 30 different words. The words consisted of a variety of both concrete and abstract words (e.g. bubbles, adorable, lather, kettle). The words varied in both length (3 to 9 letters) and syllables (1 to 4 syllables). Words were presented on a computer screen, one at a time, for 6 seconds each. The length of the word memorization task was 3 minutes and 30 seconds long. The words were pulled from a list of words (found on table 5) that were used in a prior word recognition and recall study (Huff & Hutchison, 2011). The words were carefully selected from this list to ensure they had no synonyms designed to entice false memories. The amount of words (30) was selected because prior research supported the use of 30 words on a 25 minute long survey; and reported good reliability and validity (Judde & Rickard, 2010). The words selected for this study are provided in the Appendix.

Implicit Association Test (IAT) Selection

The implicit association test (IAT) was custom designed for this study and served the purpose of a distraction task (Carpenter, 2015). The IAT tested for positive and negative word associations of flowers and insects. The IAT task was 10 minutes long, and served the sole purpose of keeping participants engaged while occupying their attention. Iatgen software was used to construct this test (Carpenter, 2015).

Demographic Questionnaire Selection

The demographics questionnaire was broken down into four categories, and assessed for age, gender, socioeconomic status and ethnicity. This information was primarily used to describe the sample.

Procedure

Participants were asked to take part in a 2 (Music: Music or No Music) x 2 (Mindfulness Task: Meditation or Distraction IAT task) factorial online experimental study that was distributed on Sona via Qualtrics. They were informed that the online experiment would be able to be completed in approximately 30 minutes or less. Participants were first asked to formally agree to participate in the experimental study by signing an informed consent form. All Participants were informed that they would participate in a 3 minute and 30 second word memorization task, where they were asked to memorize a list of 30 different words; and that each word was individually presented on screen for 6 seconds each. Participants were randomly assigned to complete the word memorization task under one of two conditions; either with background music, or without background music. After the memorization task was completed, participants were again randomly assigned to participate in either a 10 minute guided mindfulness meditation task, or a 10 minute distraction task using an Implicit Association Test (IAT). After the mindfulness meditation or IAT tasks were completed, participants were asked to reflect on their experience with the task that they had been assigned to. They were asked to report any feelings and emotions they had experienced. Next, the participants were instructed to complete a 3 minute and 30 second word recall task, by typing out as many words that they could remember in any order. During the word recall task, participants who had participated in the music condition, also completed the word recall task while listening to the same song; and, participants who did not participate in the music condition were instructed to complete the recall task without music. Participants who had been assigned to the music condition were instructed to listen to the music at a comfortable volume. Participants were then asked to provide some demographic information. Finally, participants were instructed to read a debriefing statement in order to receive their SONA credit.

Method

A sample of 70 responses was collected for this experiment, however it was obvious that some participants skipped the meditation and/or music videos; therefore, 11 participants were excluded for completing the experiment in under 600 seconds.

This experiment was a 2x2 factorial design: 2 (Music: Music or No Music) x 2 (Mindfulness Task: Meditation or Distraction IAT task) between subjects analysis of variance (ANOVA) with a Tukey Post Hoc analysis was conducted on the number of words correctly recalled. Figure 1 and 2 below represent the number of words correctly recalled in each condition as well as the number of participants that completed the experiment, in each condition.

The analysis did not include any significant main effects or interactions. Participants in Condition 1: mindfulness meditation and background music recalled insignificantly more words (M = 10.1, SD = 6.4) than participants in Condition 2: mindfulness meditation and no background music (M = 7.2, SD = 7.7). Participants in Condition 3: distraction IAT and background music recalled insignificantly more words (M = 11.2, SD = 6.7) than participants in Condition 4: mindfulness meditation and no background music (M = 7.1, SD = 4.6).

There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music F(3)=1.47, P>.05. There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music F(3)=1.47, P>.05. The results did not support that neither mindfulness meditation or music improve or aid memory recall. Figures are included in the Appendix E of our data.

Discussion

Although this study had no significant findings, we feel that it is very important not only to understand the cognitive influences this type of stress has on the human brain, but how to facilitate aiding cognitive abilities in a safe way. Especially considering the fact that many populations of people are currently being impacted by COVID in an infinite number of ways. It is very important to find ways to provide ourselves with emotional management tools that could protect our physiology and our immune system.

The current situation really limits our ability to rely on the affections and comforts of social presence, that we became so accustomed to. Since the COVID-19 pandemic has had such a powerful influence on college student's stress levels, research needs to be done to figure out healthy ways to moderate those potentially negative effects in a manner that does not risk exposure.

Prior research has taught us that prolonged stress affects neural pathways in the brain, hindering our ability to encode and recall information (Roozendaal et al., 2009). This type of research has provided insight into the complexity of neural and cognitive function and the many different aspects of memory. Comparatively, several studies have also shown that there are methods we can implement into our daily lives that can effectively improve cognition and memory. These research studies give us a greater understanding of just how much an individual's mental state can impact their overall physiology. This type of knowledge creates an awareness that can help people to maintain efficient cognitive function and greater mental health.

The hypothesis that participants who listen to background music during word memorization and recall, as well as engaging in mindfulness meditation, would recall significantly more words, was unable to be confirmed according to the results of this experiment. There were no significant differences between all four condition groups. Overall, participants in the music conditions did recall more words than those who did not listen to music during memorization and recall, but the mean scores were not significant. Though mindfulness meditation did not show significant effects in this experiment, additional studies with shorter meditation tasks may result in greater differences. It would be beneficial to expand on this research in the future.

Limitations

There are a number of limitations that need to be mentioned. The sample of participants was a majority of Hispanic or LatinX, female, low-socioeconomic status, and under the age of 25 which is not representative of the general population. It would have been preferable to collect a larger sample that was more proportionate of the general population to make more meaningful conclusions.

We did collect a reflection of how the participants were feeling after participating in each task. Although this reflection was simply used to allow the participant time to process their emotions after participating in the mindfulness meditation, it also provided some insightful information that disclosed how many participants reported feeling negative (n=17) 28.8%, neutral (n=9) 15.3%, or positive (n=31) 52.5%. It is important to note that although the distraction task was not designed to make people feel agitated, frivolous tasks could make participants feel more negative than positive. The length of the meditation and implicit association test may also have been too long, contributing to the negative feelings that people reported feeling (e.g. boredness, agitation, anxiousness, etc.).

Due to this study being administered virtually, we were unable to control for multiple factors that may have impacted our results. There was an inability to control the environment that the participants were in, therefore background distractions, participant's

posture, and the participant's engagement in the memorization and meditation tasks could not be guaranteed. Additionally, we were unable to control the volume of the music and meditation, which may have hindered the effectiveness of these conditions. Lastly, there was no way to control for thorough and proper completion of the experiment in its entirety. We are confident that engagement was an issue in this experiment due to the fact that most participants took a questionably low amount of time to complete the experiment. All of these virtual related factors may have negatively impacted the validity of the results.

Recommendations

It is recommended that future replications of this study increase the target sample size, as well as attempt to recruit a more diverse sample population. Implementing a cap on the amount of participants who complete the survey that is proportionate to the general population.

In the event that this experiment is replicated, it is also recommended that the experimenter rethinks the distraction task all together. It may be beneficial to have the participants complete a distraction task that is expected to promote feelings of positivity, similar to the mindfulness meditation conditions.

This experiment can be replicated virtually in two different formats: synchronously or asynchronously, based off of the following recommendations. It is recommended that future researchers who are considering replication of this study synchronously, meet via zoom to supervise the participants while they complete the experiment. This would control for the environmental concerns that are current threats to validity of this experimental design. Additionally, this would also ensure that participants complete the study in its entirety. If a future researcher would like to replicate this study asynchronously, advanced coding techniques would be necessary. Software that is more invasive, and has more control over the participant's computer screen would be beneficial. Participants were able to skip through the mindfulness meditation and the stimulus tasks because they were presented as videos. Therefore, controlling the videos so that they are forced to play in their entirety, by enabling an auto advance, would be very important. One would also consider utilizing an eye tracker, or making the participant think that an eye tracker is being utilized.

Because prior research indicates that mindfulness meditation and music can have positive effects on cognition and memory, it is suggested that further research be done on this topic.

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APPENDIX
ITEM A
Word List

Stripes	Concrete	Chew	Glass	Delicate	Cane
Zoo	Point	Robe	Frail	Promise	Lollipop
Plain	Banner	Lather	Pane	Cork	Adorable
Official	Bubbles	Tide	Saucer	Sweet	Fudge
Possum	Kettle	Teeth	Cookie	Bee	Polite

APPENDIX
ITEM B
Questionnaire

Incorrect Device Notification

The survey software has detected that you are attempting to take this survey from an incompatible device. The survey contains questions that will only function correctly on a computer with a keyboard. Please open this survey from a computer with a keyboard.

Informed Consent

Experimental Psychology Fall, 2020 Undergraduate students at California State Polytechnic University Pomona enrolled in an Experimental Psychology course (PSY 4433), supervised by Dr. Bonnie Thorne, are testing volunteer participants for the purpose of learning how to conduct experiments. We appreciate your participation, as it will aid our understanding of how to conduct valid research in the future.

Description: This study is designed to test memory recall. As a participant, you will be given three and a half minutes to attempt to memorize a list of 30 of words into your long-term memory. Next, you will engage in a 10-minute task that could consist of a mindfulness meditation or an implicit association task. When the task is completed you will be asked to report information about how your experience was participating in the task. You will then be asked to recall the list of words from the first portion of the survey. Finally, you will be asked to provide demographic information that will help us describe our sample.

Although we could learn about how to conduct experiments by just studying procedures in class, we feel that actually conducting experiments is the best way to ensure a solid understanding of how to conduct valuable and meaningful research. We do not anticipate the study will present any physical, psychological, social, legal, economic, or other risks to you, other than the possible inconvenience of the time for you to participate. Participation in this study may not benefit you directly. We will ask you for your name as a record of having participated in this experiment and having given your informed consent.

However, the data is confidential. We will not release data about you or your performance in this study to anyone else in a way that could identify you. If you want to withdraw from the study at any time, you may do so without penalty. The information collected from you up to that point would be destroyed if you so desire. If you are participating for course credit, this experiment is worth 0.5 credit(s) Once the study is completed, we would be glad to give you the results.

Contact Valerie Tapia at vtapia@cpp.edu or Audriana Gregorio at amgregorio@cpp.edu. If you have any questions, please ask us or contact Dr. Bonnie Thorne, bthorne@cpp.edu or (909) 869-2281. If you have complaints about your treatment as a participant, please call or write: Chair, Human Participants Committee, c/o Research and Sponsored Programs, California State Polytechnic University Pomona, Pomona, CA, 91768, (909) 869-2966. Although the chair may ask your name, all complaints are kept in confidence.

Consent

By typing your name in the box below, you confirm that you are at least 18 years old and that you understand that your participation is voluntary, and you consent to participate.

Instructions

Please make sure the volume on your device is at a comfortable level and that nothing is playing in the background. Some of the tasks in the following experiment will require you to hear. Please make sure you are sitting in a comfortable position. Some of the tasks in the following experiment will require you to be seated comfortably. Once you advance to the next page, a timer will start. You will have three seconds to press play on the video. So, press play immediately. The video will display a list of 30 words. Each word will be displayed for 6 seconds. Try your best to store these words into your long term memory, as you will be asked to recall this list of words at the end of this survey. In order to help you remember the words for longer, try to
visualize each word presented.

Condition 1: Memory Stimulus with Music

Instructions: Please make sure your volume is up. Remember, try to visualize every word you see to help you remember it for longer. Press play.

Memory Stimulus With Music Video Played Here.

The page will auto-advance momentarily.

o Ok.

Condition 2: Memory Stimulus Without Music

Instructions: Remember, try to visualize every word you see to help you remember it for longer. Press play.

Memory Stimulus Without Music Video Played Here.

The page will auto-advance once the video is over.

    o Ok.

Condition 3: Mindfulness Meditation

The page will auto-advance once the video is over.

    o Ok.

Pre-IAT Instructions

The following task will ask you to select the "E" key if the word belongs to the category on the left and "I" key if the word belongs to the category on the right. Please make sure you read and understand the instructions, before you begin the task.

Implicit Association Test (Distraction Task)

This test was a virtually coded test designed on www.iatgen.com. It instructed participants to make positive and negative associations of insects and flowers.

Questions After Task

Please describe any emotions you are currently feeling.

Please reflect and summarize your experience with the previous task.

Instructions for Recall

On the next page, you will be asked to recall the list of words that you were asked to remember at the beginning of the survey. You will have 3 minutes and 30 seconds to complete the task. You do not have to remember the words in any particular order. Please proceed.

Instructions for Memory Recall with Music

Please press play on the video below, and then begin recalling the list of yours you were asked to remember at the beginning of the survey.

Please list the words you were asked to remember at the beginning of the experiment.

1. ____	6. ____	11. ____	16. ____	21. ____	26. ____
2. ____	7. ____	12. ____	17. ____	22. ____	27. ____
3. ____	8. ____	13. ____	18. ____	23. ____	28. ____
4. ____	9. ____	14. ____	19. ____	24. ____	29. ____
5. ____	10. ____	15. ____	20. ____	25. ____	30. ____

Memory Recall without Music

Please begin recalling the list of yours you were asked to remember at the beginning of the survey. Please list the words you were asked to remember at the beginning of the experiment.

1. ____	6. ____	11. ____	16. ____	21. ____	26. ____
2. ____	7. ____	12. ____	17. ____	22. ____	27. ____
3. ____	8. ____	13. ____	18. ____	23. ____	28. ____
4. ____	9. ____	14. ____	19. ____	24. ____	29. ____
5. ____	10. ____	15. ____	20. ____	25. ____	30. ____

Demographics

Please provide demographic information about yourself below.

What is your age?_____

Choose one or more genders that you consider yourself to be:

    □ Male

    □ Female

    □ Non-Binary _____

Choose one or more races that you consider yourself to be:

    □ White

□ Black or African American

□ American Indian or Alaska Native

□ Asian

□ Native Hawaiian or Pacific Islander

□ Other _____

Information about income is very important to understand. Would you please give your best guess?Please indicate the answer that includes your entire household income in (previous year) before taxes.

o Less than $10,000

o $10,000 to $19,999

o $20,000 to $29,999

o $30,000 to $39,999

o $40,000 to $49,999

o $50,000 to $59,999

o $60,000 to $69,999

o $70,000 to $79,999

o $80,000 to $89,999

o $90,000 to $99,999

o $100,000 to $149,999

o $150,000 or more

Debriefing

Thank you for your participation in this experiment! Please do not discuss the details of this research with other students, as they may participate in this or similar studies in the future. The goal of this study was to determine the effect of mindfulness meditation and music on long-term memory. The purpose of this study is to inform the field of psychology from a cognitive processes perspective on how holistic interventions can impact cognition. A potential benefit of this study is that results would help us better understand how relaxation techniques improve cognition in real-world settings face.Your participation is not only greatly appreciated by the researchers involved, because the data collected could possibly provide evidence relevant to how to aid telehealth students and workers. In this experiment, you were instructed to complete an encoding task. During the encoding task you could have been either listening to music or not. Next, you were randomly assigned to either a distraction task or a mindfulness task. After that, you were asked to reflect on your experience with the task you completed. You were then provided with a form that allowed you to report the words you were able to recall. Finally, you answer demographic questions that will help us describe our sample. If you have any questions or concerns about this study, please contact:

Primary Investigator: Dr. Bonnie Thorne, bthorne@cpp.edu, California State Polytechnic University, Pomona, Psychology Department, West Temple Avenue, Pomona, CA, 91768
Co-Primary Investigator: Valerie Tapia, vtapia@cpp.edu, 909-631-3206

Co-Primary Investigator: Audriana Gregorio, amgregorio@cpp.edu, 951-538-4894

Finally, we urge you not to discuss this study with anyone else who is currently participating or might participate at a future point in time. As you can certainly appreciate, we will not be able to accurately examine participants who know about the true purpose of the project beforehand. Press the "Next" button to end the survey and return to Sona to receive automated credit for completing the study.

Thank you!

APPENDIX

ITEM C

Video Links

Condition 1: Memory Stimulus with Music

- https://youtu.be/bcqOCp1A63M

    Memory Recall with Music

    - https://youtu.be/Ko0veDQ-6kk

Condition 2: Memory Stimulus Without Music

- https://youtu.be/4SRkAZQvVR4

    Memory Recall without Music

    - No video.

Condition 3: Mindfulness Meditation

- https://youtu.be/IrKUJ7cMzpk

APPENDIX

ITEM D

Demographic Information Tables

Table 1. Participant's reported gender (n=59).

Male	15.3%
Female	84.7%

Table 2. Participant's reported age (n=58).

18 to 21	41.4%
22 to 25	42.5%
26 to 29	6.8%
30 to 32	5.1%
33 to 36	1.7%
40+	1.7%

Table 3. Participant's reported race/ethnic identity (n=59).

White	18.6%
Black or African American	5.1%
American Indian or Alaska Native	5.1%
Asian	15.3%
Native Hawaiian or Pacific Islander	1.7%
Hispanic or LatinX	42.4%
Middle Eastern	3.4%
Multi-Racial	6.8%
French	1.7%

Table 4. Participant's reported household income level (n=59).

Less than $10,000	15.3%
$10,000 to $19,999	10.2%
$20,000 to $29,999	22.0%
$30,000 to $39,999	13.6%
$40,000 to $49,999	8.5%
$50,000 to $59,999	5.1%
$60,000 to $69,999	6.8%
$70,000 to $79,999	3.4%
$80,000 to $89,999	1.7%
$90,000 to $99,999	5.1%
$100,000 to $149,999	3.4%
$150,000 or more	5.1%

APPENDIX

ITEM E

Results Figures

Figure 1: Results

Figure 2: Number of Participant in each Condition

**Haocheng
Liang**   **Smartphone-based Environmental Water Analysis Review**

Abstract

   Water is an important component of our environment, and its quality is crucial for the sustainability of ecosystem. Due to the increased amount of pollution, water quality is declining over years, and the water quality monitoring has been an important topic of environmental and analytical science. Even though many traditional methods have been developed, the requirement of expensive and bulky instruments limits the use of traditional methods for water quality monitoring. A rapid and accurate analytical method for on-site analysis is still desired in the field studies where the power source is unavailable. Recently, smartphones are rapidly developed and popularized around the globe. Smartphone-based analytical methods have been reported in many literatures, and these methods are capable for the detection of many water quality parameters, such as the trace levels of metal ions, inorganic nonmetals, organic compounds, and the pH values. Based on the target analytes, a variety of sensing techniques, such as test strips, gold nanoparticles, and electrodes, are integrated with the smartphone-based analytical methods. A review was conducted with a focus on smartphone-based analytical methods from 2018 to present. The performance and the potential of smartphones in water quality monitoring was discussed in detail. The purpose of this review is to provide an overview and the future prospective of on-site water analysis and at-home water analysis using a smartphone.

Major objective(s):

   Prepare and submit a scientific literature review focusing on the application of smartphone-based analytical methods on environmental water quality analysis to a peer-review journal.

   Background research with analysis and summary of literature review: During the background research and literature review, it was found that the latest scientific review that focused on the smartphone-based analytical method was published in 2018.[1,2] Furthermore, it was found that the existing reviews for smartphone-based analysis are mainly focused on point-of-care[2] and bioanalytical sensing.[3] It was concluded that a literature review focusing on the recent scientific research results on smartphone-based water analysis is necessary.

Methods (Experimental procedure/design):

   I started working on my review based on the work that I had done in summer for the McNair REU program, where I searched a good number of articles and sorted them into different categories. I started writing the review by writing reviews of the methodology first. Based on different target analytes in the selected articles, I divided the articles into five different sections, metals, organic compounds, inorganic nonmetals, halogen, and other. I wrote a paragraph for each article that I selected, and I put them under one of the five sections based on the target analytes. After reviewing a good number of scientific articles, the strategy was changed to spilt the sections based on the sensing methods coupling with the smartphone method.

I divided the sections into smartphone-based analytical method with nanoparticles, smartphone-based analytical method with electromaterials, smartphone-based analytical method with colorimetric methods.

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):

During the academic year of 2020-2021, I finished writing the draft and editing drafts of the review articles, including introduction, conclusion, abstract, and the review sections. I submitted the paper to Dr. Liu for further editing. I learned a lot from preparing this review. I have attached a copy of my manuscript in this email.

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?

At this point, I would say I made good progress on my work and I achieved my goals.

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(2) Xu, D.; Huang, X.; Guo, J.; Ma, X. Automatic Smartphone-Based Microfluidic Biosensor System at the Point of Care. Biosensors and Bioelectronics. 2018. https://doi.org/10.1016/j.bios.2018.03.018.

(3) Zhang, D.; Liu, Q. Biosensors and Bioelectronics on Smartphone for Portable Biochemical Detection. Biosensors and Bioelectronics. 2016. https://doi.org/10.1016/j.bios.2015.08.037.

Huerta
Demetrio

Using Citric Acid to Activate Charcoal Obtained From Agricultural Wastes as anAffordable Alternative to Adsorb Oil From Water

Abstract

Oil spills are polluting bodies of water around the world every day harming the environment and all life. Consequently, there is a dire need for a solution to remove oil from water. A commonly used material is activated carbon (AC) which can adsorb organic compounds while having a high surface area to make the best use of its adsorbing ability. But the cost of commercially produced AC is too expensive for developing countries because most AC is made from fossil coal and wood since their properties make them easy to manipulate to give them a porous structure. This generates the need to find resources far more cheaper and sustainable that can be transformed into AC that is capable of the same adsorption as commercially AC. In this study, agricultural wastes (pistachio shells) were chosen as a viable option due to their low cost, accessibility as a renewable resource, and are considered environmentally friendly. As for the method of activating the pistachio charcoal, citric acid obtained from lemon juice was used for environmental and cost purposes. The AC produced from pistachio shells using citric acid was found to successfully adsorb oil but not to the same capabilities of commercially produced AC. Pistachio shells are thus a great material to produce AC. However, findings suggest they may need to be activated using more efficient methods for reaching the full adsorbing potential.

Introduction

There is an increasing need for solutions to cleaning up contaminated water around the world. One of these contaminants that are extremely harmful to the environment and its ecosystem is oil. Oil can have devastating impacts on ocean and river environments short-term and long-term [1]. As such, one event that helps to understand the impact of oil on the environment and its ecology is the 1996 North Cape oil spill. In that oil spill alone, it was estimated that 8-9 million lobsters met their deaths [2]. The importance of finding solutions to clean up pollution in waters around the world is thus clearer.

Fortunately, activated carbon (AC) is deemed as one of the best solutions in removing organic compounds in water and air such as oil according to the United States Environmental Protection Agency (USEPA) [3,4]. Unfortunately, commercially produced ACs are expensive as they are produced from mainly fossil coals and woods [5]. This has led to an increase in interest to find more affordable and sustainable resources to be turned into AC of which agricultural wastes have been one of the most popular resources [6]. Apart from agricultural wastes being low-cost, it is also an environmental issue around the world as there is an excessive amount of it which makes it an even more popular choice of material to produce AC [7].

In this review, it was sought out to use an effective alternative material to produce AC while using an unusual method of activation to extract oil from water. For this study, agricultural waste (pistachio shells) was the material of interest and citric acid found in lemon juice was used as the activating agent.

In the following section, the significance of AC will be discussed along with details of what materials can be used to derive it while describing the applications and effectiveness of those ACs. Due to resource limitations, an alternative method to activate carbon was introduced using citric acid from lemons. Finally, the methods of experiment along with the results will be discussed to determine the level of success of the pistachio shell activated carbon (PSAC).

Literature Review

AC is a material that has an impressively large surface area due to its porous morphology and can adsorb organic compounds [7,8]. Adsorption is the process by which a solid holds molecules such as chemical pollutants, to its surface [3] whereas in absorption molecules are entering the solid. By definition, AC's very large surface area just makes it all the more effective as an adsorbent which is where it separates itself from regular carbon. Regular carbon can also adsorb organic compounds but because it does not have as large of a surface area as AC, it would take a greater quantity. The two processes by which carbon is activated are physical activation and chemical activation. In physical activation, the raw material is first carbonized by heating, then it is physically activated by heating the material in a vacuum or inert gas atmosphere from 750 to 1000 °C. In chemical activation, the raw material is impregnated with a chemical, and they are both heated at the same time in an inert gas atmosphere which carbonizes and activates the material at the same time. Chemical activation is a much longer process than physical activation due to it having to be washed and dried to rid of the chemicals, and consequently, most commercial AC is produced using physical activation [9]. Although physical activation is more timely, chemical activation is favorable in that it leads to higher yields and better development of pores in the structure of the AC [10-12].

As previously stated, most AC is produced from coal or wood, but agricultural wastes are advantageous since it is affordable and abundant [10,13]. It is becoming clearer that agricultural waste can be successfully converted into high-grade AC as the following examples prove otherwise. Coconut shell AC that was washed with acid was found to adsorb 61%, 39%, and 66% of color, total suspended solids, and chemical oxygen demand from palm oil mill effluent, respectively [6]. Using variations of both methods of activation, strawberry seeds, and pistachio shells were converted into AC that could successfully adsorb 4-chloro-2-methylphenoxyacetic acid, 2.4-dichlorophenoxyacetic acid, and crystal violet [5]. Of course, depending on the material (strawberry seeds or pistachio shells) and the method of activation, some samples were better than the others at adsorbing one of the three adsorbates. There is no one best activating agent or method as it all depends on what compound or molecule is sought out to adsorb [7]. In another study, orange peel was found to be an effective material to produce highly porous AC [10]. Thus, agricultural waste is an intriguing and effective precursor for AC.

While the materials used to produce AC are relatively important, the process of activating the carbon can also be costly and must be taken into consideration as well [9]. Therefore, a method that can be afforded and used in developing countries is needed along with a low-cost material. Citric acid is an alternative cost-saving method activating agent that has not been proven to successfully activate carbon but has been suggested by sources to do so. In an online article, it is suggested that calcium chloride can be replaced by lemon juice to activate charcoal [14]. In a video, it is demonstrated how AC can be made using

lemon juice [15]. Citric acid was also found to affect the morphology of AC in several studies that used citric acid to modify AC [16-18]. The results that are fascinating in these studies, is the increase in pore sizes in the AC caused by citric acid. Although pore size was increased, it was reported by all that there was a decrease in surface area in the citric acid modified ACs. They all attributed this to the small molecule size of citric acid that caused blockage within the pores. It must be noted that these studies were not activating but modifying carbon that has already been activated. This experiment differs in that citric acid is used to attempt to activate carbon. From what is known, there have not been any scientific studies on activating carbon using citric acid, thus it has not been proven that lemon juice can activate carbon. However, the initial study results are promising in that citric acid for small scale experiments can be used in cases of limited resources and to reduce costs. As previously stated, it is known that citric acid can cause larger pores in AC but due to blockage caused by the small particle size of citric acid, the overall surface area is reduced. What is of interest, is whether the positive effects can outweigh the negative effects when using citric acid on regular carbon rather than carbon that is already activated.

Methodology

3.1 Preparation of Pistachio Shell Activated Carbon (PSAC)

The following steps to prepare the PSAC were influenced by Ruff's online article [14] and an online video [15]. Pistachio shells were bathed in distilled water for 24 hrs then let sit to completely dry for another 24 h. The pistachio shells were then placed in a pot with the lid on top leaving a small gap to allow for any smoke and gas to escape during the pyrolysis process. Using a grill, the pistachio shells were pyrolyzed at around 315 °C until no more visible smoke or gas could be seen escaping from the pot. The pistachio shell charcoal was then rinsed with distilled water to rid of any remaining ash and debris. Using a mortar and pestle the charcoal was then grinded into a fine powder then it was let to completely dry for 24 h. A solution containing 1 part pulp-free lemon juice and 3 parts distilled water was mixed then added to the charcoal in a container until it was paste-like. The pistachio shell charcoal was then covered and let sit for another 24 h. After 24 hrs the charcoal was thoroughly rinsed one last time with distilled water to rid of most of the lemon juice. The charcoal was then moved to a clean pot and cooked for 1.5 hrs to completely dry and finish activating. The activated charcoal was then cooled before being used in the experiments.

3.2 Experiments

3.2.1 Test to Determine Whether Activation Was Successful

The rationale behind placing AC in water is that there should be a formation of bubbles from the air trapped inside the pores of AC, thus proving the carbon was activated successfully. For clarification, this experiment does not in itself determine whether charcoal is activated but can be used as an indicator. The influence of this experiment was drawn from an online video [19]. A tablespoon of the PSAC and store-bought activated carbon (SBAC) were each added to different cups filled with water. It was then observed if there were any bubbles and if so, how many bubbles each one produced.

3.2.2 Adsorption Effectiveness

To determine the effective adsorption capabilities of the PSAC an experiment was conducted to compare it to SBAC. To start, ¼ tsp of each of the PSAC and the SBAC was placed on a sheet of aluminum foil paper.

A dropper was then used to drop 5 drops of extra virgin olive oil to both samples every 5 minutes. The 5 minutes allowed for both AC samples to have the time to adsorb as much oil as it could before another 5 drops of oil were added. The 5 drops of oil were repeatedly added every 5 minutes until one of the samples visibly could not adsorb any more oil. Finally, to confirm the results the aluminum foil paper was held vertically to allow any if any, oil to drip down the foil paper. This was observed to determine which of the AC samples had a higher adsorption capability.

3.2.3 Effectiveness in Removing Oil from Water
       To determine the effectiveness of the PSAC in removing oil from water an experiment was conducted. Similar amounts of extra virgin olive oil and water were first added into 2 identical cups. Next, 1 tbsp of the PSAC and SBAC were added to their respective cups and mixed well. As a control for the experiment, a third identical cup was filled with only water. For the control, it does not matter which AC sample is added to the water as long as it can be observed what would happen if there was no oil with the water. For this experiment, the SBAC was added to the control and mixed well. Observations were then made at 10, 20, 30 minutes, and at 1, 2, 3 hrs to determine whether the samples effectively adsorbed oil when in an oil/water mixture.

Results/Analysis
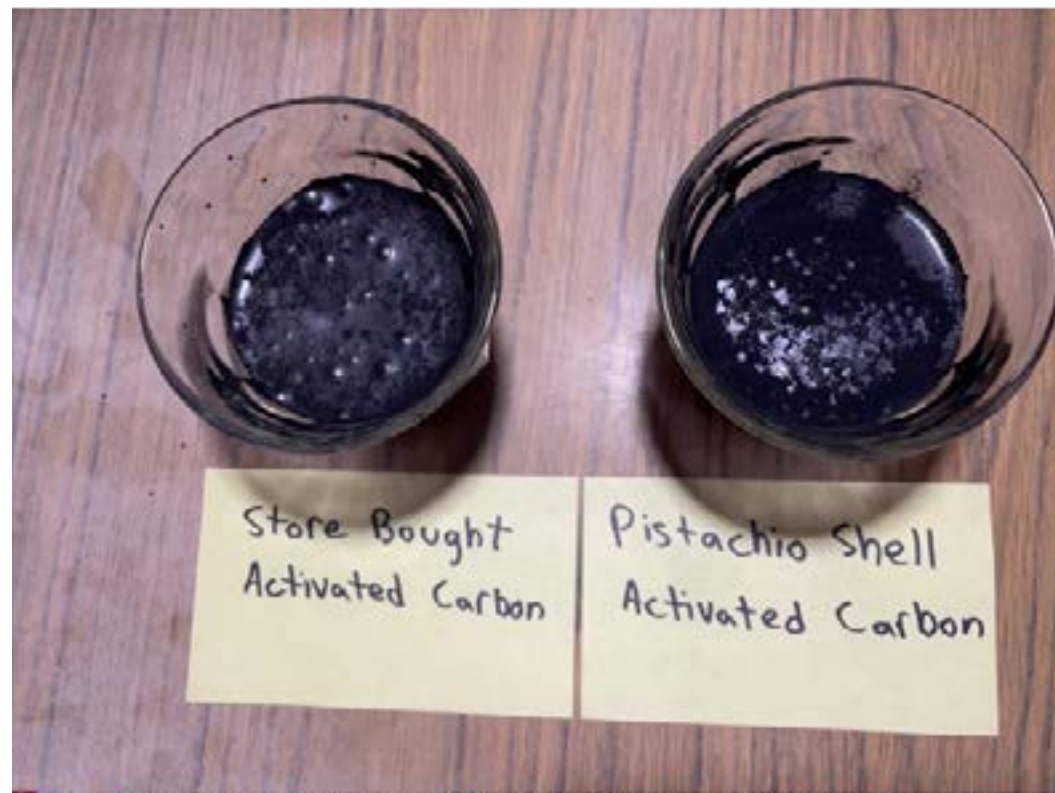
Image 1: Shown are the reactions when SBAC (left) and PSAC (right) are added to water.

       The following data is qualitative as only observations were made to describe the experiments due to the unavailability of proper instruments. In the first experiment seen in Image 1, both the PSAC and the SBAC showed bubbles and fizzing when they were added with water. The difference between the two was that the SBAC noticeably produced more bubbles than the PSAC. This can presumably be from the fact that the SBAC contains more pores in its structure than the PSAC.
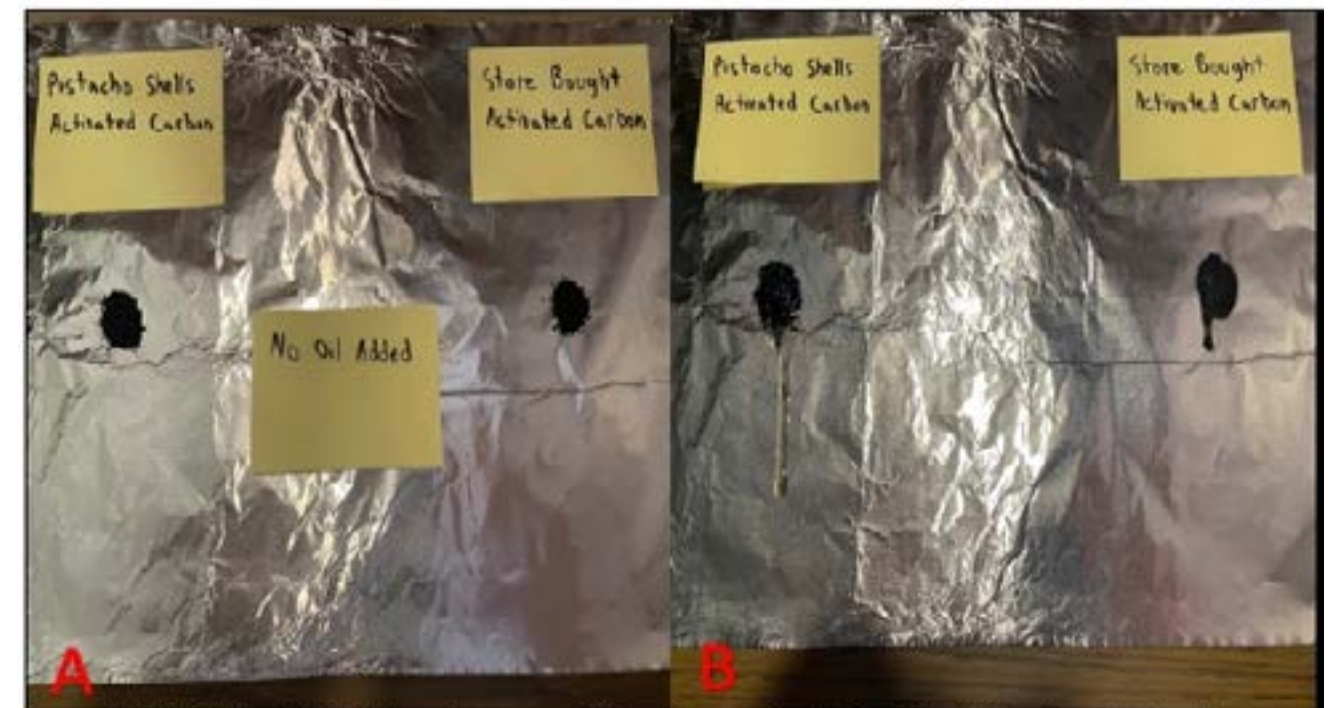
Image 2: PSAC and SBAC are shown in (A) with no oil added and in (B) with a total of 35 drops of oil added to each.

       In the second experiment seen in Image 2, SBAC was found to adsorb more oil than the PSAC. At first, after 5 drops of oil were added every 5 minutes, it was observed that both were able to adsorb the oil, until around 30 drops of oil. After 30 drops of oil were added to both, it can be seen that the PSAC was about to reach its maximum adsorption point. At 35 drops of oil, it was evident that the PSAC could no longer adsorb any more oil. In Image 2B, it can be observed that the oil in the SBAC was adsorbed well, as not much excess oil was able to drip down. This is not the case with the PSAC as a decent amount of oil was able to drip down.
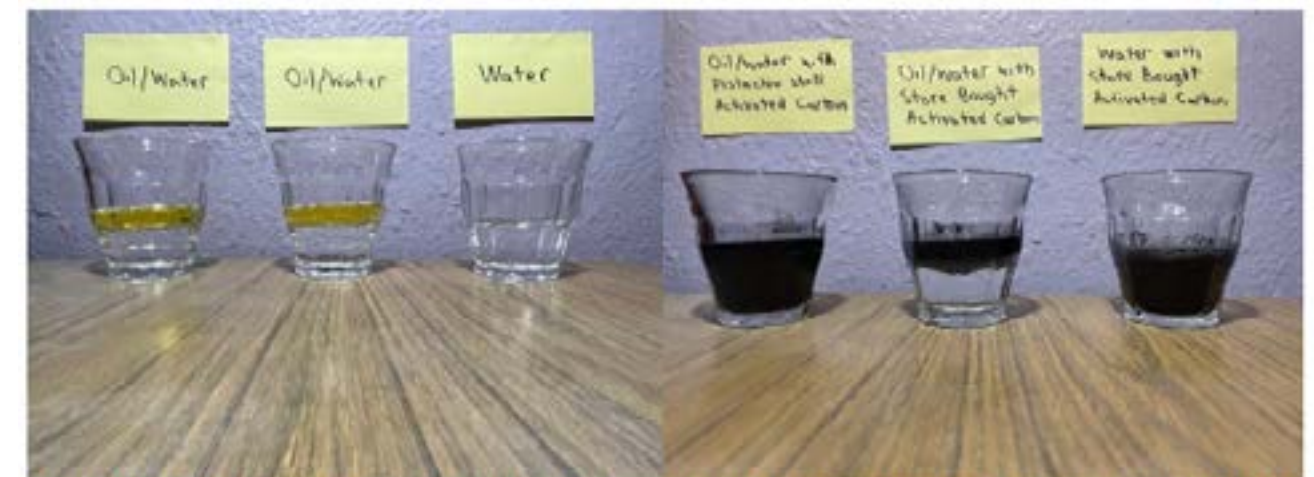
Image 3: Shown are 3 cups, 2 with oil and water (left and middle cups), and 1 with only water (right cup).

Image 4: Shown is PSAC carbon mixed into the left cup and SBAC mixed into the middle and right cup.
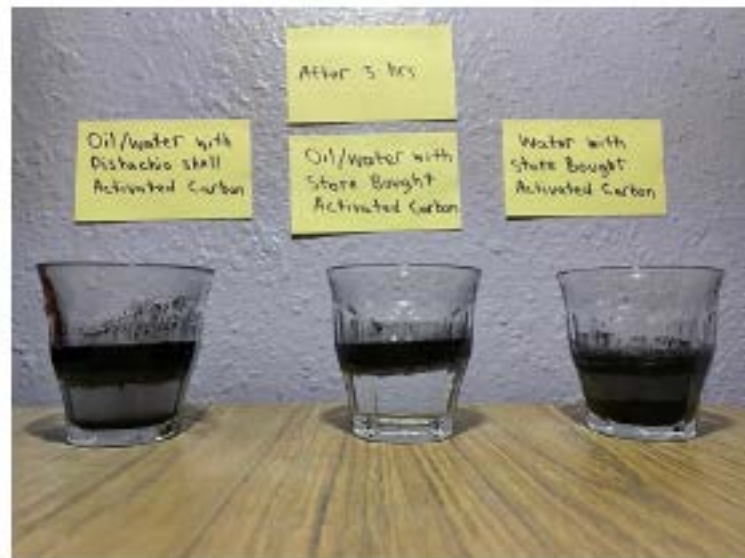
Image 5: Shown are the three mixtures after 3 hrs have passed.

In the third experiment seen in Images 3-5, it is tested to see how well the samples of AC perform in removing oil from oil and water mixtures. It was observed from the moment of adding the AC samples to the mixtures that the SBAC performed remarkably better than the PSAC. It seemed as if the PSAC was a complete failure at first but as time went by, it was observed that it was slowly adsorbing the oil. Whereas the SBAC was immediately effective in adsorbing the oil from the oil-water mixture. The cup filled with water that was mixed no oil, the AC is mixed with the water as there is no oil for it to be attracted to. Whereas when SBAC was mixed with water and oil, the AC was immediately attracted to the oil to adsorb it. This is the ideal situation as the goal is to adsorb only the oil and not add anymore pollutants to the water.

Discussion

As seen in the results across all experiments, the PSAC produced using citric acid was just not quite as effective as the SBAC. To summarize, the SBAC was found to contain more pores, adsorb more oil and be more effective in removing oil from water than the PSAC. Although outperformed, the PSAC showed some positives. It was found to produce bubbles when added with water which is a good indicator that it was successfully activated. More importantly, it was found to adsorb oil from water given time. As stated earlier, citric acid modified ACs were found to have a decrease in their surface area [16-18]. This cannot be ignored and must be stated as the most probable cause the PSAC was not as effective as the SBAC. Perhaps, a portion of the surface area was blocked from the small citric acid particles. This would negate the effects of increasing pore size. In this case, citric acid would not be the best activating agent as the negative effects can and seem to outweigh the positive effects.

Conclusion

It is obvious from the results that the PSAC did not meet the requirements to replace commercially produced AC. From research, it can be pinpointed that the source of error was most likely the method of activation. Specifically, the citric acid found in lemon juice was found to be not as effective as other activation methods.

Citric acid was a skeptical choice in activating carbon from the start, therefore, the PSAC was not expected to perform as well as the SBAC. Although not a complete success, the results were promising in that pistachio shells can be used as an effective precursor to AC. Pistachio shells yielded an adequate amount of carbon and were easy to work with. For these reasons, pistachio shells can one day replace coal and charcoal as a precursor for AC. For future implementations, developing a more efficient method of activation is a necessity to prepare AC from pistachio shells that can replicate the efficiency of commercially produced AC. As more research is done into different kinds of agricultural wastes, AC can one day become affordable and available to all around the world so that all can benefit from its properties.

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Jarrin   **A Cross-Cultural Model of Systemic Trust and Reasoning**
Luis   **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 about 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, and New Zealand.

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 predictthat 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) and Canada (N = 497). 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

	United States	New Zealand	Canada
Red Cell scale			
Overall scale	0.91	0.85	0.87
Subscales			
Social science	0.73	0.74	0.73
Physical science	0.94	0.93	0.93
Personal opinions	0.89	0.88	0.89
Predictors			
Authoritarianism	0.63	0.64	0.58
Tolerance for Ambiguity	0.46	0.37	0.44
Feelings are truth	0.83	0.85	0.85
Perception of resource availability	0.90	0.84	0.86
Ingroup trust	0.71	0.67	0.68
Outgroup trust	0.74	0.77	0.69
Science trust	0.85	0.84	0.86
Institution trust	0.85	0.81	0.86
Outcomes			
Covid-19 Symbolism	0.83	0.82	0.81
Social Dominance Orientation	0.82	0.78	0.80
Covid Misinformation Belief	0.78	0.78	0.81
Covid-19 worry	0.92	0.88	0.89
Covid-19 danger perception	0.77	0.79	0.84
Brand Prestige	0.84	0.84	0.83
Brand Expression	0.78	0.78	0.79

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 = .06, CFI = .97), 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		Canada		New Zealand		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overall Red Cell scale	3.15	2.62	2.79	2.51	2.60	2.37	2.85	2.51
Subscales								
Personal opinions	-3.82	3.42	-3.28	3.13	-3.16	3.17	-3.42	3.26
Social science	1.35	2.79	1.20	2.68	0.88	2.62	1.15	2.70
Physical Science	4.33	3.61	3.92	3.56	3.80	3.56	4.02	3.58

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.

	United States	Canada	New Zealand	Total
Authoritarianism	**-0.16**	**-0.18**	**-0.21**	**-0.19**
Tolerance for Ambiguity	**0.10**	0.14	0.03	**0.08**
Feelings Are Truth	**-0.18**	**-0.25**	**-0.26**	**-0.23**
Social ideology (Higher = more liberal)	0.05	-0.03	0.11	**0.01**
Economic ideology (Higher = more liberal)	-0.02	0.07	**-0.16**	-0.01
Outgroup trust	0.05	**0.17**	0.02	0.07
Institutional trust	**-0.23**	**-0.20**	-0.10	-0.21
Trust in science	**0.19**	**0.25**	0.02	**0.18**
Ingroup trust	**0.07**	0.01	0.07	**0.05**
Perception of resource availability	-0.01	-0.02	0.05	0.03
New Zealand dummy coding				-0.06
Canada dummy coding				-0.07

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 our set of outcomes – Covid-19 misinformation, Covid-19 misinformation, brand expression, Social Dominance Orientation, Covid-19-related danger and worry, and concern about Covid-19 restrictions as dependent variables. 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.

	United States	Canada	New Zealand	Total
Outcome: Covid-19 symbolism				
Authoritarianism	-0.03	0.14	**0.14**	0.07
Tolerance for Ambiguity	-0.05	-0.05	-0.05	-0.06
Feelings Are Truth	**0.06**	0.07	0.07	0.11
Social ideology (Higher = more liberal)	**-0.12**	0.04	0.04	-0.01
Economic ideology (Higher = more liberal)	**-0.09**	-0.01	-0.01	-0.06
Outgroup trust	**0.08**	0.09	0.09	**0.12**
Institutional trust	-0.02	-0.09	-0.09	**-0.07**
Trust in science	**-0.33**	-0.21	-0.21	-0.29
Ingroup trust	0.02	-0.02	-0.02	0.00
Perception of resource availability	**0.12**	0.06	0.06	**0.10**
New Zealand dummy coding				**-0.11**
Canada dummy coding				-0.01

	United States	Canada	New Zealand	Total
Red Cell Scale	**-0.10**	-0.22	**-0.22**	**-0.19**
Outcome: Covid-19 Misinformation beliefs				
Authoritarianism	0.04	0.06	**0.12**	**0.08**
Tolerance for Ambiguity	-0.03	-0.06	-0.08	-0.06
Feelings Are Truth	**0.12**	**0.15**	**0.16**	**0.17**
Social ideology (Higher = more liberal)	**-0.09**	-0.02	0.07	0.01
Economic ideology (Higher = more liberal)	0.01	0.01	0.01	0.01
Outgroup trust	**0.06**	0.05	-0.02	**0.04**
Institutional trust	**0.10**	0.03	-0.01	**0.07**
Trust in science	**-0.30**	**-0.39**	**-0.28**	**-0.30**
Ingroup trust	0.01	-0.03	0.08	0.03
Perception of resource availability	0.13	-0.01	0.00	**0.05**
New Zealand dummy coding				**-0.09**
Canada dummy coding				-0.03

Red Cell Scale	-0.20	-0.17	-0.21	-0.23
	United States	Canada	New Zealand	Total
Outcome: Brand expression				
Authoritarianism	-0.04	-0.06	0.06	0.02
Tolerance for Ambiguity	**0.07**	-0.04	-0.07	0.00
Feelings Are Truth	**0.23**	**0.24**	**0.10**	**0.20**
Social ideology (Higher = more liberal)	0.07	**0.13**	0.08	**0.08**
Economic ideology (Higher = more liberal)	0.02	-0.06	0.13	0.04
Outgroup trust	-0.05	-0.02	0.02	-0.02
Institutional trust	**0.29**	**0.17**	**0.13**	**0.21**
Trust in science	-0.05	0.01	-0.04	-0.03
Ingroup trust	0.01	-0.05	-0.04	-0.01
Perception of resource availability	**0.14**	**0.09**	0.04	**0.10**
New Zealand dummy coding				-0.13
Canada dummy coding				-0.05
Red Cell Scale	-0.15	-0.21	-0.25	-0.21

	United States	Canada	New Zealand	Total
Outcome: Social Dominance Orientation				
Authoritarianism	0.00	0.06	**0.13**	**0.07**
Tolerance for Ambiguity	0.00	**-0.11**	-0.05	**-0.06**
Feelings Are Truth	-0.04	0.01	-0.05	-0.02
Social ideology (Higher = more liberal)	**-0.29**	-0.11	-0.01	**-0.12**
Economic ideology (Higher = more liberal)	-0.09	-0.11	**-0.11**	**-0.10**
Outgroup trust	-0.14	-0.06	**-0.13**	**-0.10**
Institutional trust	0.01	0.04	**-0.13**	0.00
Trust in science	**-0.13**	**-0.20**	-0.07	**-0.18**
Ingroup trust	0.02	0.01	0.04	0.03
Perception of resource availability	**0.11**	**0.12**	0.02	**0.10**
New Zealand dummy coding				0.03
Canada dummy coding				0.02
Red Cell Scale	**-0.12**	**-0.11**	**-0.15**	**-0.17**

	United States	Canada	New Zealand	Total
Outcome: Worry over Covid-19				
Authoritarianism	0.00	0.02	**0.13**	**0.06**
Tolerance for Ambiguity	0.02	0.04	0.01	0.03
Feelings Are Truth	0.05	-0.08	0.07	0.01
Social ideology (Higher = more liberal)	**0.13**	0.11	0.08	**0.11**
Economic ideology (Higher = more liberal)	**0.13**	-0.03	0.01	0.04
Outgroup trust	**-0.12**	-0.07	-0.04	**-0.08**
Institutional trust	**0.20**	**0.26**	0.11	**0.19**
Trust in science	**0.19**	**0.12**	0.09	**0.15**
Ingroup trust	-0.01	-0.04	-0.06	-0.04
Perception of resource availability	-0.06	-0.04	-0.07	**-0.07**
New Zealand dummy coding				**-0.20**
Canada dummy coding				**-0.08**
Red Cell Scale	-0.05	-0.07	**-0.14**	**-0.09**

	United States	Canada	New Zealand	Total
Outcome: Perceived danger of Covid-19				
Authoritarianism	0.03	0.04	-0.07	0.02
Tolerance for Ambiguity	0.05	0.08	0.03	**0.07**
Feelings Are Truth	-0.02	-0.10	0.03	-0.02
Social ideology (Higher = more liberal)	**0.10**	-0.07	0.04	0.04
Economic ideology (Higher = more liberal)	**0.13**	**0.14**	-0.01	**0.09**
Outgroup trust	**-0.11**	-0.03	**-0.16**	**-0.10**
Institutional trust	**0.09**	**0.21**	**0.17**	**0.14**
Trust in science	**0.34**	**0.28**	**0.19**	**0.29**
Ingroup trust	-0.03	-0.04	0.00	0.00
Perception of resource availability	0.00	0.02	0.01	0.02
New Zealand dummy coding				0.02
Canada dummy coding				-0.03
Red Cell Scale	0.01	0.04	**0.12**	**0.06**

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.

Results are graphed in Figure 1. Overall the model showed good fit, RMSEA = .05, CFI = .92. 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 each tested outcome in each country.

Figure 1. SEM path estimates for each country. Significant effects are bolded.
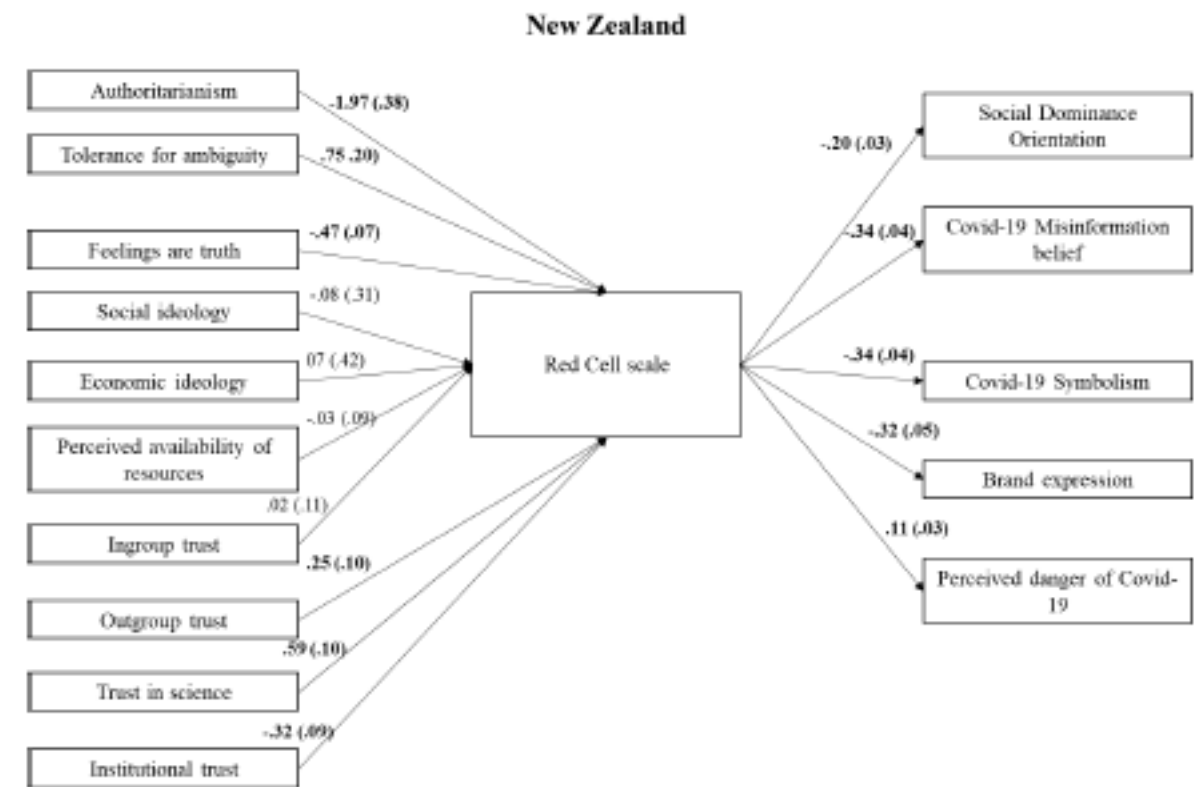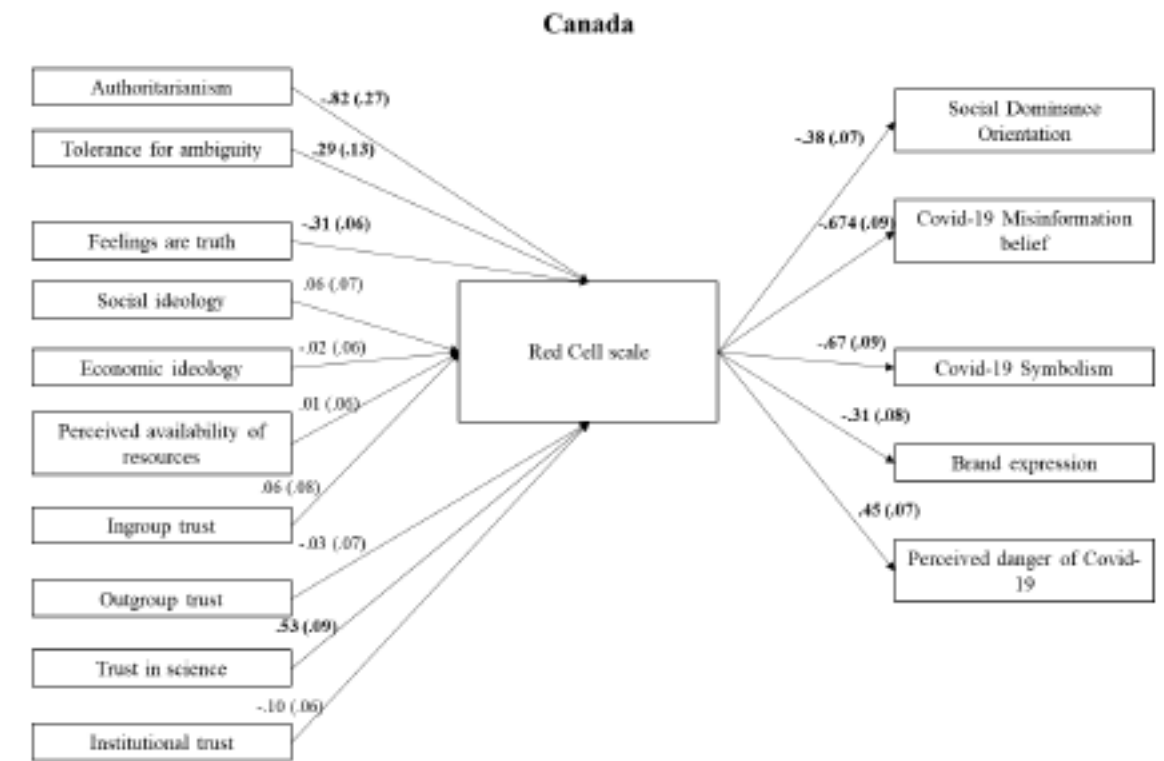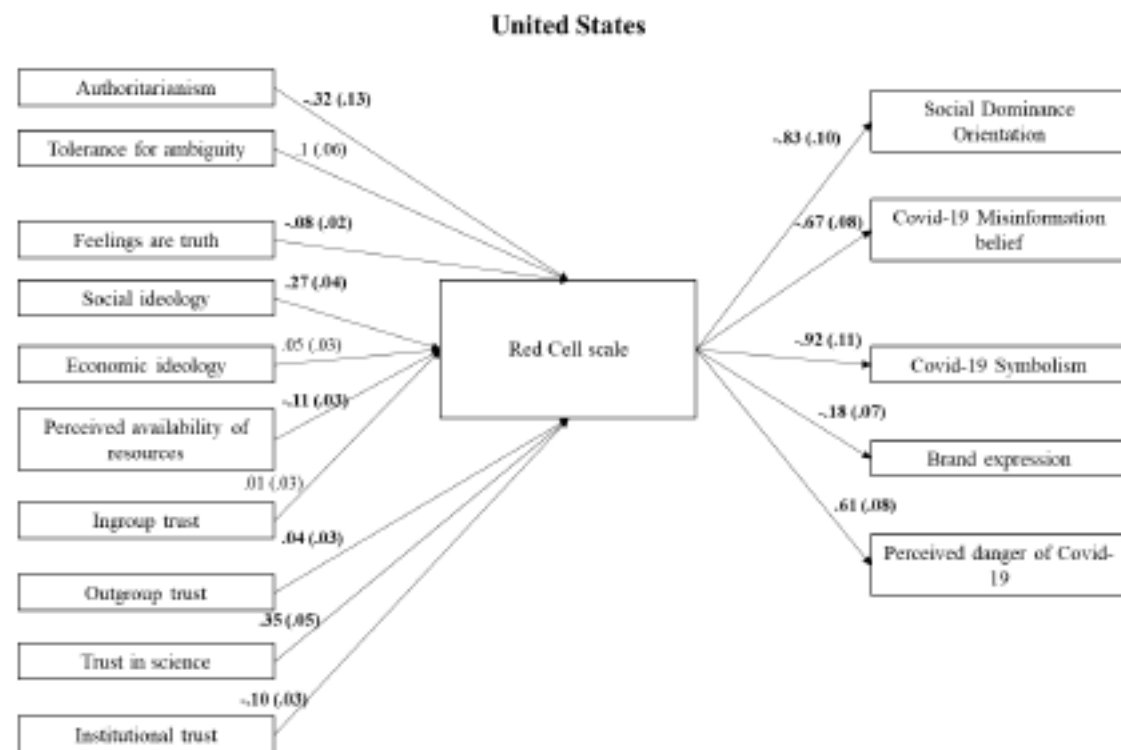
Discussion & Conclusion

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

Jurado   **Solar Fuel Cell Charging System for Small-Scale UAV**
Ana

Abstract
        Interest in clean and renewable energy is at an all-time high as the environmental benefits, among other advantages of these energy sources, far outweigh those of fossil fuels. One source of this clean energy that is gaining more attention and is being used to power various kinds of vehicles is energy from Solar Fuel Cells. This paper examines how a small Solar Fuel Cell kit can be optimized and scaled up to produce enough power to recharge the battery of a small Unmanned Aerial Vehicle (UAV). This was done by finding the theoretical representation of the power from the Fuel Cell and Solar Cell and later conducting various experiments with said Solar Fuel Cell kit. Then the results of the two were compared and the kit was scaled up in order to fit the UAVs estimated specifications.

Keywords: solar fuel cell, UAV, charging, energy

Introduction
        The use of solar fuel cell systems to power different kinds of small robotic vehicles has been growing, as this clean energy source has many advantages over traditional batteries and power sources. From the low cost of these energy sources to their low impacts on the environment, it is a better alternative to more commonly used carbon-emitting energy sources. However, the design of these systems has to be changed and optimized to fit the different needs of the varying specific applications. Previous works have shown how solar fuel cells can be used to power different unmanned aerial vehicles (UAVs) in combination with batteries. This paper will investigate the changes and adjustments that are to be made to an existing solar fuel cell kit to allow it to charge a small-scale drone/UAV.

2.1 Advantages of Solar Fuel Cells

        As mentioned above, solar fuel cells have many different advantages over other commonly used sources of energy. One of the main advantages solar fuel cells hold over traditional energy sources is that they are a clean energy source. Meaning that, unlike fossil fuels, there is little to no carbon emission or combustion exhaust gases being caused by their use [1] [3]. This reduces their impact on the environment, which is very important given the current state of global climate crisis. The only products created from the use of fuel cells, besides the electricity that is wanted, are water and low amounts of heat. The fuel cells also do not require high temperatures in order to work. This is yet another advantage over traditional power sources. Traditional power sources tend to require higher temperatures to produce electricity, limiting them to certain applications that can withstand that heat. The low temperatures required for solar fuel cells to work allow these to be used in mobile applications, such as small vehicles, robotics applications, unmanned aerial vehicles (UAVs), etc. [7].

        Another important quality that solar fuel cells have is their efficiency and high energy density [3] [7]. The efficiency of these fuel cells is a great asset as they are the most energy efficient devices for extracting power from fuels [12]. The energy density that these fuel cells have is also a great asset when compared to batteries. Fuel cells are a power source with significantly higher energy density than lithium-ion batteries which is why they are sought

after by many industries and for various applications [10]. Solar fuel cells are also known for producing electricity without producing lots of noise. They are also available at a relatively low cost [2]. Although the materials needed to create a fuel cell are more on the expensive side, the fuel cell itself is made available at a low cost when compared to other clean energy sources. The combination of the advantages offered by fuel cells over traditional power sources is what makes these fuel cells the ideal source of clean energy for the small UAV that will be used in this study.

2.2 Parts of a Solar Fuel Cell

        In order to better understand how a fuel cell works, the parts of one must first be explained. There are various kinds of fuel cells available, from Alkaline Fuel Cells to Phosphoric Acid Fuel Cells, they all vary slightly in how they work [3]. Although the end product of all is the same, and their advantages are similar, the fuel cells themselves are not all the same. For this study, a Polymer Electrolyte Membrane (PEM) Reversible Fuel Cell will be used, along with a solar panel, to create a solar fuel cell system. This type of fuel cell uses hydrogen as the fuel needed to produce electricity [2]. The process begins with a solar panel which acts as an electrolyzer to produce hydrogen from the water through electrolysis [11]. It is that hydrogen that then becomes the fuel for the fuel cell and allows it to produce electricity.

        Once the hydrogen has been separated it then passes through the fuel cell. The fuel cell is made up of an electrolyte placed in between two electrodes, a cathode and anode. As shown in Figure 1, the hydrogen gas flows into the fuel cell and as it passes through the anode it separates into protons and electrons (shown as 2H+ for the protons and 2e- for the electrons). However, the membrane in place only allows the protons (2H+) to pass through. The electrons are redirected through an external circuit towards the cathode. It is this flow of electrons (2e-) that functions as the electricity produced by the fuel cell. When the electrons go back to the fuel cell into the cathode, they combine with air entering the fuel cell and the protons from the anode to create water. Since these reactions are exothermic, heat is also released with the water as a product [1] [2] [10].

The different reactions occurring in the fuel cell are shown below.

Reaction occurring in the Anode:

$$H_2 \rightarrow 2H^+ + 2e^- \tag{1}$$
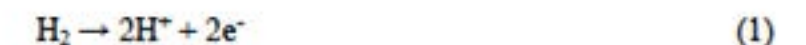
Reaction occurring in the Cathode:

$$\tfrac{1}{2}O_2 + 2H^+ + 2e^- \rightarrow H_2O \tag{2}$$

[7].
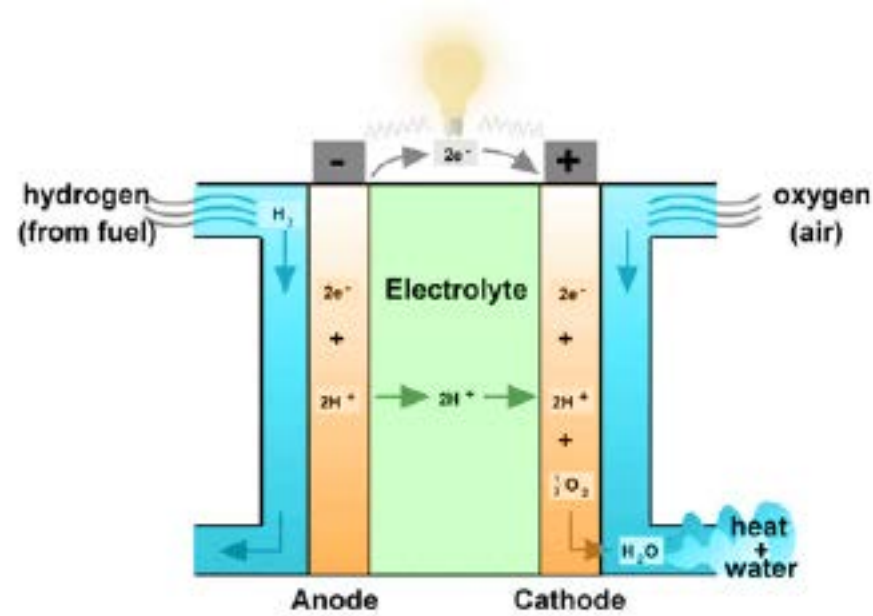
Figure 1. Diagram of Fuel Cell. Source World Fuel Cell Council.

2.3 Previous Works with Solar Fuel Cells and UAVs

Due to fuel cells having so many advantages over traditional power sources and batteries, not only has the interest in them been on the rise, their use in investigations and projects has been increasing. This is particularly obvious in works relating to unmanned aerial vehicles, also known as UAVs. The main reason for their use in these applications are their efficiency, energy density, and low operating temperatures, as discussed above [10]. However, most of the studies that have been previously done relating how fuel cells can be used with UAVs are in terms of powering the UAVs or hybrid systems that contain fuel cells being used to power these UAVs [1] [2] [7]. These studies show how a fuel cell, or a hybrid system containing a fuel cell, can be used along with batteries to fully power a UAV and also be its main propulsion system.

The focus of said studies is different from the focus of this project. However, they do provide various insights into how a fuel cell system can be made to fit different specifications. Most of the works focused on simulations of the flights and the powering and propulsion of UAVs [7]. Thorough explanations of flight simulations and how flight time was affected by fuel cells and hybrid systems was explained and demonstrated [2]. These simulations led to the different adjustments being made to the fuel cell systems in order to make them fit the desired specifications. Although most previous works focus and provide information on this different connection between fuel cells and UAVs, this project is slightly different. This project intends to adapt a solar fuel cell kit in order for it to charge a small UAV's battery, rather than be its main power source, bringing some new ideas and data sets for future works relating fuel cells and UAVs.

Methods

All of the experiments done for this project were done using the Horizon Educational Solar Hydrogen Science Education Kit (FCJJ-16). The kit contained a Polymer Electrolyte Membrane (PEM) Reversible Fuel Cell, a plastic base for the fuel cell, two different water/gas tanks labeled H2 and O2 respectively, a plastic base for both of the tanks, a mini electric motor along with a small propeller, a 1 Watt solar panel, a stand for the solar panel, about 60 cm of plastic tubing, a small 4 mL syringe, a pair of wires, and a battery pack. In addition to this kit and all of its components, an Innova 3306 multimeter and various different resistances were used to obtain the data from the experiments. The use all of components is further explained below.

In order to begin the collection of data, the solar fuel cell was first set up to break up the water, or perform electrolysis. The fuel cell was set up in its base and the small tube was cut into four different pieces, two 20 cm pieces and two 4 cm pieces. Both 4 cm pieces were connected to the top pin on each side of the fuel cell and closed with a smaller pin included in the kit. On the Oxygen side of the fuel cell, the pin was taken out and using the syringe, distilled water was added until the excess water began to flow out of the tube (less than 2 mL of water). Once the water began to flow out from the tube, the tube was capped and the fuel cell was left there for 3 minutes. The fuel cell membrane must be soaked before it is used to prevent permanent damage. During this time, both the Oxygen and Hydrogen cylinders were attached to their base, included in the kit, and were filled with distilled water. Once the water reached the "0" mark in the cylinder the inner containers were placed, ensuring the small slots on the bottom were not covered by the plastic base. At this point, the water level rose, using the syringe the excess water was extracted to ensure the level was once again at the "0" mark. Then the 20 cm tubes were connected to the top nozzles of the inner containers and the bottom pin on the fuel cell, making sure the Oxygen container was connected to the Oxygen side of the fuel cell and the Hydrogen side of the fuel cell was connected to the Hydrogen container. The final set up for electrolysis before the solar panel was connected can be seen in Figure 2.

Figure 2. Set up of fuel cell kit before electrolysis began.

After the three minutes had passed and the set up was complete, the solar panel was connected to the fuel cell using the corresponding cables. This completed set up can be seen in Figure 3. The solar panel was put under direct sunlight and the fuel cell was left to produce Oxygen and Hydrogen. Each of the gases went to their respective container and due to the water in each container, the gases were sealed in their chambers. Once the Hydrogen chamber was completely filled and bubbles began to rise from the small slots at the bottom of the inner container, the solar panel was disconnected from the fuel cell. At this point, electrolysis was complete and the containers were filled with Oxygen and Hydrogen respectively. The fuel cell could now power the small motor the kit included. In order to do this, the motor was connected to the fuel cell using the respective cables and it spun until the Hydrogen gas in the container had been completely exhausted. When there seemed to be no more gases in the containers, the small pins in the 4 cm tubes were taken out. This allowed for any left over gases to exit the tube so for any other trial the Hydrogen and Oxygen would remain pure. This also allow for the water level on both cylinders returned to the "0" mark. At this point, the process was repeated as necessary to create Hydrogen and then use the fuel cell as a power source.
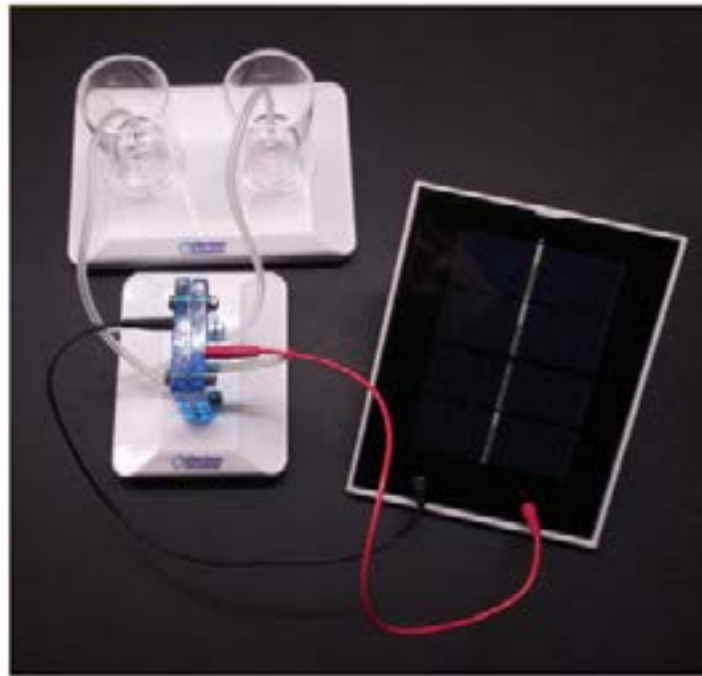
Figure 3. Set up of fuel cell with solar panel.

To begin obtaining the necessary data for this project, the voltage and current coming from the fuel cell were measured. This processs was done first with a 10 Ω resistance. Then it was repeated with various different resistances. The resistances used were 20 Ω, 30 Ω, 40 Ω, 50 Ω, 60 Ω, and 100 Ω. These different resistances simulated different loads that the fuel cell would have to charge and therefore gave different voltage and current measurements. Both of these measurements were collected at each resistance and these allowed for an I-V curve to be created. These values were also used to analyze the power being produced by the fuel cell. In order to do this, equation 3 was used to calculate the power.

$$P = V \times I$$

$$(3)$$

These early allowed for the calculating of the maximum and minimum power that the fuel cell could produce. Then these were compared to the estimated power requirements of the small drone that was to be charged by the fuel cell.

In order to calculate how much power the small scale UAV used in this project needed, the components that were expected to be used to build the UAV were analyzed. Since the drone had not been built yet, this was the best way to estimate the power consumption. The motors that were used to estimate the value were the Mayatech W2815 1800KV Hollow Shaft Brushless Motor F3P 4D 2204 for RC Airplane Spare Part. It was known that four of these motors were going to be used in the final build of the drone, so that was the information used to estimate the power consumption of the drone. Looking at the specifications chart of these motors, it was seen that one motor used with the 8040 propeller (a propeller with 8 in diameter and 4 in pitch) required a maximum of 55.5 Watts.

Specification:
Brand: Mayatech
Item name: Motor

Model	W2815 1800kv	W2815 1800kv
Voltage	7.4v	7.4v
Propeller	8040	9040
Pull(g)	375	418
Current(A)	7.5	10.8
Power(W)	55.5	79.22

Figure 4 Single motor specifications sheet Source US Banggood

This propeller size was also assumed to be used in the final build of the drone. Since it was known that four of these motors would be used along with their respective propellers to build the drone, this value was multiplied by four and the result was a maximum of 222 Watts from the motors alone. However, this value is not the exact value that will actually be required by the drone once it is completely built. Since the actual drone was not built and was not readily available for inspection, there are still many unknowns such as the weight and any other components that would need to be powered. Another thing that is being assumed in this calculation of the power, is that the drone is simply raising from the ground and remaining stationary in the air. This was also assumed since the drone was not readily available and calculating for it to be flying around would have not been accurate. This was the best approach to the power estimation, since the information regarding the drone was limited. Since all of these assumptions were done to calculate the power needed, the 222 Watts value is not the most power that the drone would require and the fuel cell would need to produce. It is, however, a good value to use for the purpose of this project and to begin thinking about the scaling of the system.

Analysis

Once the experiments were completed, the data from all of these trials was organized into the table shown in Figure 5. As it can be seen from these data points, as the resistance used was increased the resulting voltage also increased. However, with this increase in resistance, the resulting current decreased. This comes directly from the relationship

between these three values which is seen in equation 4.

$$V = I \times R \tag{4}$$

When this equation is manipulated to solve for the value of the current, the resulting relationship is seen in equation 5. This equation directly showcases the relationship visible in these data points obtained from the experiments. Current is indirectly proportional to resistance, while directly proportional to voltage.

$$I = V/R \tag{5}$$

Although the values obtained from the experiments do reflect the relationship clearly, they do not entirely follow these equations and this was expected for many reasons. In the ideal world, there would be no outside factors that could contribute to the results, but in the real world there are many other components to consider. One important factor to really consider is the tool used for these experiments, specifically the multimeter used to measure all of these values. The multimeter used only had an accuracy to the thousandths place for the voltage and to the hundreths for the current. Although the voltage one is more accurate this cannot be said about the current one. Specifically for the current values, the multimeter does not provide values that are as accurate as would be ideal for this and any other experiments. This causes discrepancies and issues in the data since values may be different than what the multimeter actually shows. An example of this can be seen in the last three current values of Figure 5, these could have easily been differing values, for examply 0.05 A, 0.06 A, 0.07 A, etc. but because of the inaccuracy of the multimeter, they all show the same value. There is no real way to show whether or not they are the same, which may cause some issues in the overall results.

Voltage (V)	Current (A)	Resistance (Ω)
0.750	0.07	10
0.770	0.04	20
0.780	0.03	30
0.783	0.02	40
0.785	0.01	50
0.792	0.01	60
1.1067	0.01	100

Figure 5. Table containing data from experiments done with fuel cell kit.

In order to begin to compare all of the data collected, these were graphed to create an I-V curve, or a polarization curve. This graph can be seen in Figure 6 and it illustrates the relationship between the two values as shown in equation 5. As it can be seen in the graph, there comes a point where the current is no longer affected by the voltage being produced by the fuel cell. Towards the right end of the graph, the curve begins to level out and remain the same regardless of the voltage produced by the fuel cell.
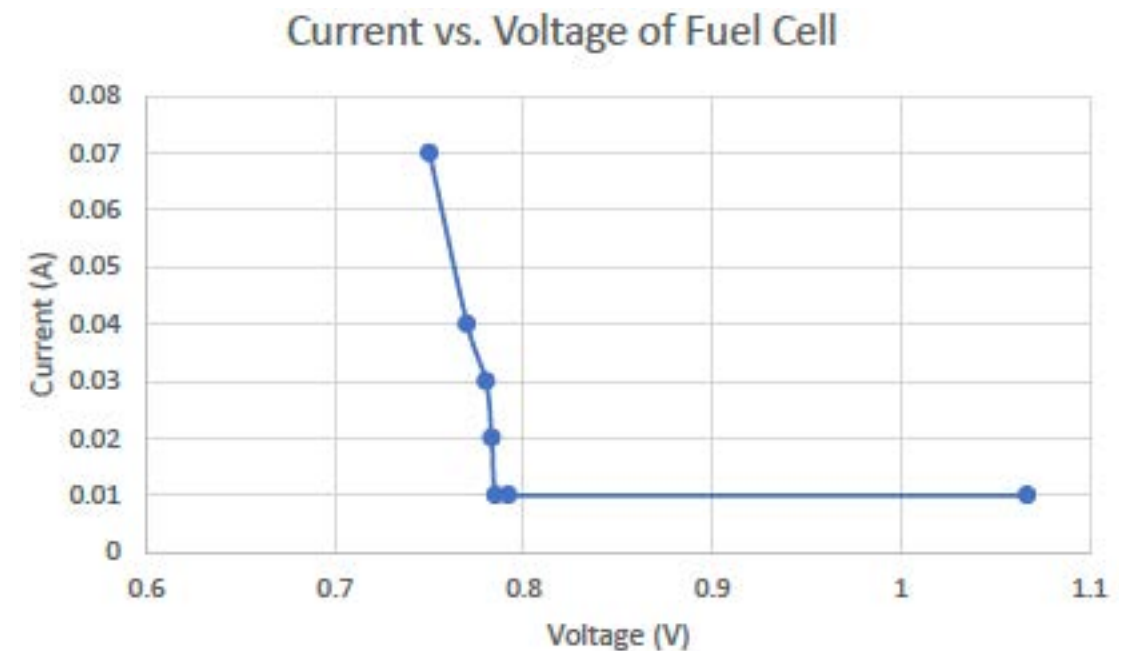
Figure 6. Graph of Current vs. Voltage at different resistances.

The next step in analyzing the data was converting the measured values of current and voltage into power to see how much the fuel cell was actually producing. This was done using equation 3 which relates all of the values measured to power. The resulting values can be seen in Figure 7 along with the respective resistances. This allows to create an idea of how the power will act as resistances increase. It also shows the maximum power that the fuel cell actually produced during the experiments. This is the power value that was used to calculate the scaling of the overall system. The reason this was the value used, was that it would give the absolute minimum value the system would have to be scaled by in order to fulfill the power requirements of the UAV. This was done primarily to serve as a building block for the future work of actually scaling up the system. The data seen in figure 7 can also be seen graphed in figure 8.

Power (W)	Resistance (O)
0.0525	10
0.0308	20
0.0234	30
0.01566	40
0.00785	50
0.00792	60
0.01067	100

Figure 7. Power values at different resistances

Power vs. Resistance of Fuel Cell
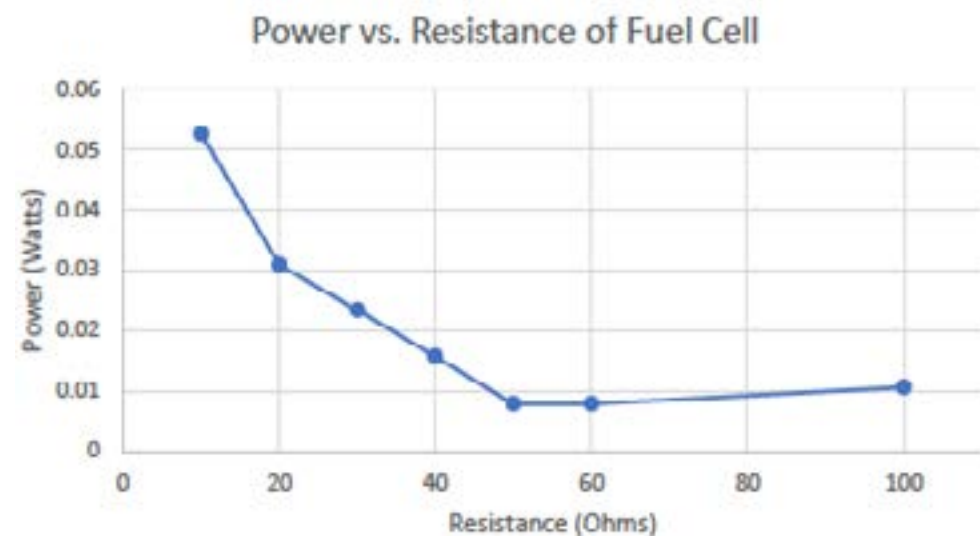
Figure 8. Graph of power vs. resistance of fuel cell.

From Figure 8, it can be seen that the maximum power produced by the fuel cell was 0.0525 Watts. In order to scale up the system to the necessary 222 Watts, this value needed to be multiplied by a scaling factor. To find that factor the 222 Watts was divided by the 0.0525 Watts produced by the fuel cell. As explained earlier, this would give the minimum number that the system would need to be scaled up by. After solving this, the scaling factor came out to be 4228.57, which was round to 4229 for simplicity. This demonstrates that in order to satisfy the power requirements of the drone, there would have to be at least 4229 fuel cells like the one used in this experiment. They would all have to be connected in series in order to produce the necessary power requirements. Although this seems like an extremely large value, considering the small amount of power being produced and the large amount of power needed by the drone, it is a number that makes sense. Despite this number not being accurate because of all of the many outside factors not being considered, it is a good place to start exploring the different ways that the system can be scaled up.

Besides finding the scaling factor that needs to be applied to this system in order to charge the drone, another very interesting characteristic of the fuel cell was found while conducting these experiments. As mentioned in the introduction, the solar panel simply serves to break up the water and allow for electrolysis to occur. It simply works to create the fuel for the fuel cell. A battery does the same exact job, just breaks up the water into Hydrogen and Oxygen. The Horizon Kit used for this experiment included both a battery pack and a solar panel. This allowed for tests to be done with both the battery pack and the solar panel. The battery pack contained 2 AA batteries which produced 3 V and 0.23 A, and the solar panel produced 2 V and 0.02 A when all the trials were done. Because of these values, on average it took about 3 minutes for the Hydrogen tank to be compeletely full when using the battery, while it took about 4 hours for the Hydrogen tank to be completely full using the solar panel. This is a very noticeable difference, however, regardless of which method was used, the fuel cell always produced the same results. This is really interesting because it demonstrated that the way that electrolysis is conducted through the fuel cell, does not affect its end product. Using the solar panels to break up the water had no effect on the power output of the fuel cell. This is something that is really interesting and opens doors when it comes to scaling up the system. It just shows that the way the water is broken up will not affect the end results of the fuel cell.

Conclusions and Future Work

In conclusion, the scaling factor for this solar fuel cell kit to be able to power a small-scale drone was found through the series of experiments done in this project. The fuel cell kit was tested with various resistances to find the maximum power produced, and that value was compared to the power needed for the drone. With this information, the scaling factor was found for the kit. The experiments were done using both batteries and a solar panel to break up the water and allow for electrolysis to occur. In doing so, it was found that regardless of which methoed was chosen to create the hydrogen and oxygen gases, the fuel cell itself would produce the same end result. The power was not affected by the batteries or the solar panel. The only difference between the two was the time it took for the water to be broken up into the necessary gases. This is something that needs to be considered when actually scaling up the system.

Since, the scaling factor of this fuel cell kit has been found, the next step and future work for this project is actually scaling up this system. Another very important thing to do is actually build the drone and compare its real power consumption to the estimate found in this project. It will most likely differ from the one used in the calculations, so there are some adjustments that will definitely need to be made to the result. Once that has been settled and completed, then the system could be accurately scaled up. There are different ways to do this scaling and all of these need to be explored in the future. There could be a number of fuel cells connected in series to satisfy the power need of the drone or there could be one fuel cell charging the whole system. These options need to be explored because things such as cost, durability, and even the type of fuel cell need to be considered. Other componets that will also need to be considred are the solar panel, or the power source used to break up the water and perform electrolysis. This system itself will also need to be scaled up with the overall system. And despite the finding that the way the water is broken up doesn't affect the end result of the fuel cell, having the hydrogen already separated and stored as a gas is also something that needs to be considered in future works.

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LeFrancois
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Embodied Narratives: Bodymind Resistance Through Storytelling

Abstract

        We live in a world governed by a racist, ableist, cisgender patriarchy. Yet, our world is, and has always been, rich in bodymind diversity and non-binary identities. With each generation, our culture continues the work to dismantle inequitable systems. We get closer to more equal distributions of power and more honest about the problematic foundations from which our sociocultural systems were created. The binary system in which we live is what governs how we educate, manage, and even view our bodyminds. It is how we learn from history and honor trailblazers from the past. It is the way in which we assign value to communities and social positions and how we apply meaning to the complex intersections of our culture. These systems produce inaccurate and incomplete histories within standardized curriculums, to which we are exposed for the majority of our education. These narratives are told from structural positions of power that reify and claim ownership of marginalized bodyminds' stories. In doing so, histories and truths are silenced and often erased. The study, Embodied Narratives: Bodymind Resistance Through Storytelling, gives voice to the suppressed truths that come from the communities of women, People of Color, and persons with disabilities. It challenges the inaccurate narratives, implicit racism and discrimination, and other conditioned beliefs that are deeply imbedded into our culture. These beliefs are at the center of this study's work of dismantling and redistributing power and access to education. Communities of activists, academics, and humanists are developing ways to intervene in this systemic and oppressive silencing. By collecting ethnographic histories from primary sources, this research centers the stories of forgotten or silenced communities by reclaiming and contributing to this generation's civil rights movement.

        American society is rooted in ableism and systems of oppression. This creates a limited, narrow definition of who has power, who is privileged, and who has access. It also regulates whom we acknowledge as valuable. If we can allow a reclaiming of these stories by collecting first-hand accounts, we will find both individual and societal benefits, such as improving mental health and equity within larger institutions. Women and Gender Studies Scholars (Bartky, 1988; Hesse-Biber; Kafai; Lorber), Critical Race Theorists (Lopez; Madrid; Morales; Yosso), and Disability Studies Scholars (Clare; Garland-Thompson; Lakshmi Piepezna-Samarasinha; Linton) have written about how the medical industrial complex and patriarchy have oppressed and pathologized disabled women of color. These scholars have found a distinct creation of binary identities where there are non-binary complexities. People are categorized as disabled or abled, man or woman, and cisgender or transgender. Their identities and bodyminds are spoken for, hierarchized, and labeled as "good" or "bad"—then become trapped within these labels and assume whatever power, privilege, or access they are granted (or not granted).

        This study seeks to investigate how embodied storytelling might impact institutions and social change. Based on work in Gender and Women's Studies, Disability Studies, Testimonios, and Critical Race Theory, this research hypothesizes that telling one's own bodymind story will generate a reclaiming of power and ownership while fostering community and social change. It is hypothesized that the act of telling one's story will humanize marginalized experiences that have been told from those in power. It will center the experiences of Disabled Women of Color, particularly given our ableist and patriarchal culture. The goal is to examine the lessons people have learned about their bodies through storytelling, and to collect accurate stories and histories from primary sources.

        The disproportionate distribution of power that restricts our bodymind identities and positionalities is the central justification for this ethnographic analysis. Right now—in the middle of a Pandemic and in the midst of a civil rights movement—the systems that govern us are being questioned and disputed. This time of revolution in our world is an opportunity to reclaim ownership of bodyminds and redefine storytelling as a form of activism and social change. To collect the stories of Disabled Women of Color, and non-binary individuals, is a step toward social transformation and self-actualization, wherein all bodyminds are granted equal and equitable treatment and opportunity. It will be a collection of "[stories] of homecoming" and political action (Morales, 2013, p. 40). It will act as a continuation of empowerment work from scholars like Aurora Levins Morales (1998) who explains that "there is no neutral body from which other bodies deviate" (p. 3). It will be an additional piece to the revolution that is happening around us and by us. The examination of storytelling and its effects will further our understanding of the self and how it is an act of political activism and community-building by way of reclaiming ownership of our bodies. Centering our bodymind stories is an act of self-reclamation and social transformation which gives this research purpose.

Method

Participants

        As this is a living project, the sample size thus far is 25 with the majority of participants identifying as women at 76%; 16% identified as men, 4% as transgender, and 4% as non-binary. Of the 25 participants, 60% were between the ages of 18 and 25, 28% were between 26 and 33, and 12% were between 34 and 41. All but 3 participants identified with having disability(ies). Subjects recruited through Cal Poly Pomona University's surveying system, SONA, were compensated with SONA credit. Subjects were also recruited outside of CPP by way of snowball sampling and social media flyer announcements. All subjects participated voluntarily and did so based on mental health and societal benefits rather than compensation.

Materials

        The design of the study is a semi-structured interview via Zoom's video platform. Though interviews are able to be delivered in Spanish and American Sign Language, all subjects have interviewed in English. In order to ensure internal validity and avoid any confounds, all subjects are asked questions from a standardized script. Interviewers received the same training and followed the same procedures to ensure inter-rater reliability and video recordings have been archived and kept confidential. Should future publication be an option, subjects have provided pseudonyms. If subjects intend their shared narratives to be included in any written collection, their stories will remain anonymous. Questions asked during the interview pertained to participants bodymind experiences, their perception of their

communities' representation, and their motivation for involvement in social change. Data was analyzed following Grounded Theory procedures created by Barney Glaser and Anselm Strauss. Methodology guidance was offered from Brené Brown's literature review of Grounded Theory and her idea of trusting emergence. This is the concept of trusting the actual data and people's lived experiences to develop theories, rather than proving or disproving any existing theories. This means that instead of starting with a question and hypothesis, researchers start with a topic, hear the stories, develop a theory, and see how and where it fits within the literature. Brené Brown asks herself as the researcher: "What were their main concerns? What were they trying to do? What were they surprised by?" (Brown, 2012). Story transcripts were read and analyzed by using these methods and others within diverse and intersectional studies. The results were informed by the frameworks of Intersectional Feminism, Critical Race Theory, Women and Gender Studies, and Disability Studies.

Procedure

Prior to conducting the interviews, subjects read and signed their consent, received a list of counseling resources, and were reminded that they may stop the interview at any time. Subjects then scheduled their interview, completed a demographic survey, and received appropriate zoom credentials. Following the interview, participants were debriefed on both the short-term and long-term goals of this project. The study is an expansion of an autoethnography, to be defined as, an in-depth self-examination of social position in the world. It examines the influence of larger institutions such as education, medical, economics, family, etc. on one's attitudes, beliefs and behaviors toward society and body-image (Wall, 2006). Because systems of power marginalize women, BIPOC (Black Indigenous People of Color) and persons with disabilities (and because these systems disempower their stories and voices), data was collected through open-ended questions. This was to ensure an unobtrusive opportunity for subjects to reclaim their stories.

Results

While there were four core themes derived from the data, additional themes to explore in future stages of the project are: the role of education in first-person storytelling, patriarchal lessons, and the effects on intersectional identities by the recent Trump administration. Evidence found within the data point to a need for further analysis into the aforementioned sub-themes. The first core theme falls under ideological oppression. Participants recounted stories of invalidation, cognitive dissonance, pressure to code-switch based on gender, patriarchal lessons according to gender, experiences of racism, ableism, homophobia, and societal exclusion. These themes were revealed when asked about safe spaces, whether they felt their community's stories and histories were accurately represented, and if they were able to recall moments of invalidation based on their communities. Something to note within this theme were the gender differences between responses. When asked about safe spaces, women and non-binary participants described who and what embodies a safe space or an unsafe space. Men-identifying participants unanimously expressed an inability to imagine what an unsafe space might be. This supports future stages of this project to investigate patriarchal impacts on storytelling. A core theme of empowerment and liberation was reflected by participants expressing a desire to

become more involved in community and social change. Many participants expressed appreciation and feelings of liberation at being offered an uninterrupted opportunity to share. Similar responses referenced feelings of inclusion, often described as "freeing", when exposed to the inclusive-centered demographics survey. Most participants recalled having to identify with inaccurate ethnic, gender, and educational descriptions when responding to studies in the past. When choosing between a short list of options, participants explained feeling forced to choose an option with which they do not identify. The juxtaposition of those experiences and seeing their specific community listed on this study's survey, brought up feelings of liberation and empowerment for the majority of participants. Activism and community involvement was a third theme that was revealed throughout the interviews. The majority of participants explained that they intend on becoming more involved in social change and that they plan on spreading awareness/education within their respective communities. Many spoke of wanting to educate their children differently from the status quo, advocating for themselves and others, and unlearning certain beliefs they have been taught. The final theme of inaccurate or absence of representation came about when participants were asked about how their community's stories were represented in their education. Some participants explained that lack of representation was a motivator for becoming involved in this research. Absence of representation was expressed by participants within LGBTQIA+ communities and disability communities. Inaccurate or lack of representation were histories of communities of color. Many noted that their community's contributions to history were ignored or glossed over and that stories of mistreatment were downplayed or falsely taught.

Discussion

Due to the complex layers and subcategories of themes found within the data, additional methods of collection will be considered, including written testimonios and surveys. As many participants shared stories and histories that involve intersectional impacts, additional questions pertaining to gender role, social status, disability experience, and ethnicity will be explored. Responses included sub-themes of patriarchal lessons, the role of education within first-person storytelling, and the effects on intersectional identities by the recent Trump Administration. These are topics to be further investigated in the next stages of the project. Because participants expressed the desire to become more involved with social change, data collection may include follow-up interviews to measure reliability of expression of activism. This project will continue to recruit more participants to obtain a larger sample size. It will also look to Grounded Theory more closely during analysis procedures.

The basis of this study is grounded in systemic and institutionalized oppression. The foundation of these oppressions directly impacts marginalized communities of color, gender, and ability(ies). The stories behind these bodyminds have been buried and suppressed for generations, and result in a lack of representation, inaccurate representation, disempowered bodyminds, and a hesitancy to advocate for one's communities. In order to change the status quo and dismantle interdisciplinary forms of oppression, continued investigating is required.

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Li   **Business Improvement Districts and Gentrification in Ethnic**
Breanna   **Enclaves thorough Social Media**

Introduction

Business improvement districts (BIDs) is an urban policy designed to improve certain neighborhoods, usually ones that are economically struggling. Their goal is to clean up and modernize a neighborhood in order to spur economic growth, utilizing sanitation efforts and marketing tactics. BIDs, however, tend to contribute to gentrification. Often, the consequences of BID actions lead to displacement of traditional business owners and long-time residents and a changing character in the neighborhood, depending on how it is marketed.

Gentrification of neighborhoods can come in the form of economic growth, where a neighborhood expands and changes at the expense of the residents. In most Chinatowns, a majority of businesses are owned by the residents living there, consisting of herbal stores, family restaurants, knick-knack shops and local grocers. However, business may become skewed towards these new trendier restaurants, clothing stores and art galleries, often displacing these traditional stores. The growth from these new stores brings in a new demographic that does not necessarily represent the original neighborhood and drives up the neighborhood value. Increases in overall rent prices can exceed the amount that local residents and shops can afford. This is the case with L.A. Chinatown, as mom-and-pop stores are gaining less attention and newer, less traditional shops are (Hom, 2020). There is the added layer of BIDs and how their work can contribute towards this trend.

This research project will focus on the marketing tactics that are employed by the BID in Los Angeles Chinatown, specifically on their target audience on Instagram. The research question guiding this project is how has the L.A. Chinatown BID marketed the neighborhood through their social media? And were there any changes post-COVID? It is expected that the BID markets L.A. Chinatown towards the younger generation, through a modernized and trendy lens, and tends to promote newer businesses that are deemed "photo-worthy." With the recent pandemic, there has been a strong emphasis in supporting local businesses, so the BID may have redirected its focus to older establishments. The research will be conducted through a qualitative method that looks at social media posts, compiling the marketing framework of the posts and analyzing them based on their frequencies.

Research question

How has the L.A. Chinatown BID marketed the neighborhood through their social media? Were there any changes post-COVID?

Literature review

Business Improvement Districts (BIDs) are a tool used in urban policy to promote economic development in generally low-income neighborhoods. The goal of these strategies is to generate more economic growth by either improving the physical appearance of an area or by modernizing the neighborhood. While the residents and business owners see the desirability and advocate for the usage of BIDs, the impact of BIDs are often the opposite of their original goals, creating new issues that cause gentrification and the displacement of native residents and businesses. There is a particular tension between the residents who want to bring in more money and those who seek to preserve the traditions and older stores in the neighborhood (Li, 2015).

BIDs are able to change the physical appearance of a neighborhood by encouraging practices that make an area safer and cleaner. Residents saw that their neighborhoods got cleaner, safer and more desirable as a result of BID activities and became more satisfied with the neighborhood conditions. A byproduct of the cleanliness of a neighborhood is increased foot traffic, leading to increasing sales for businesses and creating economic benefits for the entire community (Elmedni, 2018). An example of the improvements of neighborhoods is depicted in the growth of BID activities in Los Angeles Chinatown in the 2000s. Property owners voted in favor for a BID that used money towards sidewalk sweeping, graffiti removal, private security patrols and tree and shrubbery planning. Part of the BIDs goal was to lure in visitors through neighborhood improvements. Many community stakeholders, residents and business owners saw these changes as positive as it brought economic benefits and redevelopment back to the area (Lin, 2008). Several other BIDs in Downtown Los Angeles go further to even mask and displace the homeless population in their neighborhoods in order to promote cleanliness and economic growth in a neighborhood. A particular BID did so with an A.C.T.I.O.N program that creates "Purple Patrol" security guards. These policies and programs show the extent BIDs are willing to go to ensure that an area is desirable to residents and businesses. Efforts to promote cleanliness and redevelop the neighborhood's aesthetic encourages economic growth, making the prospect of BIDs popular to the people within a community. (Marquardt, 2012).

The strategies employed by BIDs vary by community depending on what the community needs. Particularly in ethnic neighborhoods, such as Chinatown, there is a different sort of emphasis used in advertisements to promote the neighborhood. Some Chinatowns have BIDs that try to market a neighborhood by engaging in touristification, a phenomenon where the culture of a neighborhood gets exploited to better advertise the area towards tourists. Making an area appear more "exotic" yet friendly allows for more tourism and economic activity. Chicago's Chinatown has repackaged their narrative to appear more desirable in order to commodify the area, which indirectly causes gentrification. Ethnic neighborhoods have been increasingly competitive in the tourism industry, as they see the industry as a method to enhance neighborhood businesses and values. City tours around Chicago present their Chinatown as a familiar area but with "exotic" differences. The tours emphasize visual and symbolic images, such as oriental patterns, animals and colors. This pushes regular businesses to exploit these generic images in an attempt to modernize and bring in more business. The new characterization for Chicago's Chinatown focuses on the foreignness of the area, such as referencing traditional holidays, foods and so on, while making the neighborhood appear welcoming and warm. This is a stark contrast to America's past characterization of Chinatowns as dirty, impoverished and illegal. The discourse around Chinatown is still focused on institutionalized "othering" culture, in which the "other," also known as the tourist, takes an Oriental trip minutes away from Downtown into another culture, commodifying the ethnic and traditional values that regular residents have grown up with. The tours reference certain aspects of the culture that are prominent but often do

not reflect the actual practices and allows tourists to marvel at and exploit these ideas as a form of entertainment (Santos, 2008).

A similar story is seen in Singapore's Chinatown where there has been an increase in tourist activity. In order to bring tourism in, Chinatown is painted as a familiar yet different area that tourists can enjoy. Their Chinatown is marketed towards tourists as a "free-frame theme park," coordinating furniture, signage and garden greenery to create a certain aesthetic that is neither historically correct nor accurate representative of authentic Chinese culture. Tours often neglect major subcultures of China because they over emphasize the use of Mandarin language as opposed to other significant Chinese dialects. As another marketing method, the Chinatown tourism industry draws the image of an "Orientalist caricature" that exoticizes cultural conceptions in order to satisfy the needs of tourism. These changes come at the expense of the local community and are a mere artificial image of Chinatown that lacks truth. Overall, these changes to Chinatown have not benefited anyone besides tourists. The genuine community find it hard to go on with their everyday lives and the tourists can be robbed of the authentic experience that Chinatowns can provide (Henderson, 2000).

Another method that BIDs tend to implement is the marketing of neighborhoods through an added focus on creating a youthful, trendy atmosphere that welcomes in a new demographic. New businesses are opening that are specifically targeted towards the younger generation. For example, new boba milk tea shops or pretty dessert shops are opening up in neighborhoods so that the youth are attracted to it. One revitalization plan to garner support from the younger generation is by having night markets. Though it is not a BID activity specifically, the revitalization plan's motivations are similar to the BIDs: economic growth. In Vancouver's Chinatown, they hold Night Markets that provide cultural foods, goods and music. The mantra of the Chinatown Night Market is to push a "live-work-play" philosophy, encouraging fun along with everyday life (Pottie-Sherman, 2013). New residents eagerly consume the "live-work-play" narrative and visit only the trendier shops displayed in markets rather than original businesses (Li, 2015). These markets create a "consumptionscape" view, where businesses are able to capitalize on ethnic consumer preferences, towards Chinatowns. Not only do these night markets appear cultural, but they also generate more revenue for the neighborhood. Beyond that, the new phenomenon occurring across Chinatowns is the growth of trendier shops that appeal to a younger generation that ultimately kicks out smaller knick-knack grocery shops and phases out the older traditions and culture (Pottie-Sherman, 2013).

BIDs and local governments also may promote boutiquing, the act of building new boutiques in a neighborhood, and upscaling to advertise an area, consequently causing gentrification. In the New York Harlem area, state and local governments have enacted policies to support business improvements and developments to increase the neighborhood value. City funds that go towards empowerment zones allow many new boutiques to be built. Often, boutiques replace the stores that the neighborhoods grew up with, because as a neighborhood value goes up, so does the cost of living. Residents and businesses have left the area and also experienced extreme inequalities because they are unable to pay for the housing and rental costs. Long-term residents are uncomfortable with the new stores because the ethnic ownership and characters of local stores are no longer there. Boutiques

make an area appear higher end and "mark" an area as "safe" for investment. Small locally owned shops are replaced with pricey designer shops, chain stores and branches of Chase Manhattan Banks. Small grocery and hardware stores or ethnic clubs morph into trendy restaurants targeted towards a different audience (Zukin, 2009). Similarly, the L.A. Chinatown has displaced many mom-and-pop shops because the BIDs push for a new bohemian and entertainment scene in the neighborhood. Redevelopment efforts have disrupted community stability and the new trendy boutique shops being built are displacing traditional mom and pop shops (Lin, 2008). BIDs and the government are often so focused on capitalizing off the neighborhood that they neglect the small businesses and low-income residents. The work that BIDs use reflects the visions of an upscaled, revitalized city where the urban space is used for capital gains. The social infrastructure, regulations, new shops, and public space are all dictated by local policies and BID efforts. While they seek to revitalize an area, many practices are targeted towards investors and newcomers as opposed to the residents and small businesses. Many pop and pop shops, traditional herbal and small grocery stores have been displaced by new chains that play a vital role in the changing landscape of Chinatowns (Li, 2015).

With all this happening, there has been a recent growth in the resistance against the gentrification that BIDS may be encouraging. This includes grassroot organizations within the Chinatown communities who are engaging in activities that cater to residents, rather than outsiders. The recent efforts in Singapore's Chinatown have brought about a lot of mixed responses from stakeholders and people within the community, as the organizations note how traditional trades and shops are replaced with trendy restaurants, expensive boutiques and souvenir shops (Henderson, 2000). Similar movements are occurring in America as well, especially in Manhattan's Chinatown. Grassroots organizations argue that preserving the culture of the neighborhood is more of a priority than other economic incentives (Li, 2015). The younger generation and women from the neighborhood are engaging in what is known as "shop talk," or the informal discourses with elderly residents and business owners. Younger generations can inform the elders about politics surrounding Chinatown, and the elders can tell the youth what they want for the future of the neighborhood. Shop talk allows for a new engagement and connection for the community to their roots and each other, which is a powerful resistance against the new trendy era for Chinatowns that promote gentrification and modernization (Wong, 2019).

In 2020, there may be a greater shift towards preserving traditional cultures in ethnic enclaves like Chinatown. COVID-19 has not only wreaked economic havoc on businesses but has also brought about xenophobic sentiment. The unemployment rate among Asian Americans increased 450% between February and June of 2020. This high rate is partially driven by the lack of tourists and consumers due to the pandemic, but also partially due to the anti-Asian sentiment that has pushed many away from Asian businesses (Jagannathan, 2021). However, coronavirus has also paved a trend towards shopping locally, including areas like Chinatown and other ethnic neighborhoods. 67% of consumers in a survey have responded positively towards shopping locally and helping out businesses that are struggling in their area (Schmidt, 2020). This gives hope to the many smaller stores in Chinatown, where the pandemic and anti-Asian sentiment has hit hard, but many are continuing to support them. With the changing times, the activities of BIDs could possibly shift away from the trendy oriental marketing methods previously employed and focus

more on maintaining traditional shops and restaurants. This research explores the shift in BID marketing tactics during COVID-19, specifically if it is occurring and in what ways it's happening.

Methods

This is a qualitative research project, where the Instagram posts of L.A. Chinatown in 2016 and 2020 were examined. 2016 was used for a post-COVID environment to really get a background on the BIDs works and 2020 was used as a time during COVID to see if there were any notable changes in marketing tactics. Their Instagram is run by the BID, so it informs this research in terms of understanding the advertising techniques they use to promote the neighborhood. The posts were then coded according to business type, generation, if it is a corporation and if it is an ethnic business. Each post also got analyzed under the framework of Chinese American culture, youth-oriented culture, creative or artistic culture and foodie culture. A descriptive analysis of these nominal and ordinal variables is measured, which took in the frequencies of the numbers and cross-tabulated the variables to find intersection between them. The research is also informed by my RIO mentor, Professor Hom's ethnographic fieldwork collected from 2014 to 2017 containing of interviews with Chinatown community leaders, including members of the BID, and observations of BID board meetings and BID-sponsored events.

Description of the case

Los Angeles Chinatown first came about around the 1870s and was known as "Old Chinatown." Old Chinatown was demolished for the creation of Union Station due to urban planning and was rebuilt in 1938. The area was originally predominantly European and Mexican American, however after the 1964 Immigration and Nationality Act, which permitted more Asian immigrants to move into the United States, the area became majority Asian American. L.A. then went on to move Old Chinatown into what is now considered "New Chinatown" in order to centralize transportation efforts and to utilize the old area for something different. This transition caused a lot of dissonance in the neighborhood and can be marked as the start of gentrification of Chinatown (Hom, 2020). By the 1990s, new art galleries were replacing old trinket stores and many storefronts were empty. This led to the creation of a BID focused on efforts to bring back economic growth into the area. Shortly after the BID was established, new restaurants and boutiques that catered to a different demographic were established, expensive modern apartments were built and many chain stores, like Starbucks and a Walmart supermarket were added (Lin, 2008). This activity, paired with the way that the BID has marketed the neighborhood, has caused changing cultural activities, contributing to the gentrification narrative.

Findings

This research paper focuses on how the Los Angeles Chinatown BID has marketed their neighborhood through social media and if there were changes during the pandemic. After examining Instagram, it was clear that the advertising in the neighborhood centered around promoting events, restaurants and shops towards the youth, and if applicable, as "foodie culture." However, as COVID-19 swept across America, along with a movement

towards emphasizing local businesses, the BID has redirected its focus on older shops that have Asian roots.

Role of aesthetics

An important aspect of the BID is how they market the neighborhood in terms of looks. Throughout the literature review, it was mentioned that BIDs focused on cleanliness and modernization in order to make a neighborhood comfortable and friendly (Elmedni, 2018). In doing this, the BID is able to increase economic expenditures in the area. The L.A. Chinatown is no different, as it emphasizes the aesthetic nature of the neighborhood.

Chinatown has been built and modernized in a way that encourages photography and social media. In Professor Hom's notes, she attended the Chinese New Year's Parade and Festival and saw people "posing in front of the benches with the confetti gun and posing to take pictures at the right moment as they let the confetti gun go," realizing that the Central Plaza may have been designed to have a "good photo opportunity to get either a picture of the Chinatown gate or the different pagoda awnings" (Fieldnotes, Feb. 2016). In another visit, Professor Hom observes Chinatown Summer Nights, a popular event in Chinatown that is sort of like a party where there are concerts, food and drinks. During this, Professor Hom takes a picture of confetti and lanterns, thinking that she will post it. She observes that many around her are doing "the same thing that a lot of other younger people are doing too -- [having] an Instagram moment (Field notes. July 2015). The BID successfully created a neighborhood that is photogenic and inspires the people visiting to take pictures and post. This is a successful strategy in marketing the neighborhood, framing it in a way generates interest and encourages others to come.

Throughout the Instagram feed in 2016, the BID reposted pictures that other people took and tagged as Chinatown. A total of 54 posts were not of businesses or events, but rather of the aesthetic nature of Chinatown. These pictures were mainly of the temples, neon lights and hanging lanterns. A part of this is to show how pretty and photogenic the neighborhood is. The BID wants people to take pictures of the neighborhood and post because it draws attention to the neighborhoods and encourages other people to visit and enjoy. This is evident because the BID reposted pictures of social media influencers to show how popular the location is. This also ties into how the BID markets towards the youth, as it is mainly the younger generation that visits places for pictures or enjoys an "Instagram moment." A lot of the pictures also note the neighborhood's distinct characteristics, which exoticizes the area. Many pictures are of a statue of Bruce Lee, pagodas and hanging red lanterns, all which are distinctly Asian and oriental.

In 2020, there were significantly less posts of aesthetics, as the BID focused on protecting and promoting neighborhood businesses. Instead of the 54 posts seen in 2016, there were only 5. Of that 5, all captions were either updates on the neighborhood during the pandemic or to write an uplifting and encouraging message. The data here suggests a shift in priorities of the BID after COVID-19, specifically towards spending in certain businesses.

Youth-oriented culture:

Table 1

2020	Framing as Youth Culture		
Generation	No	Yes	Grand Total
Events	23	11	34
Legacy (before 1970s, Chinese)	4	7	11
New Immigrant (after 1970s, immigrant owned)	33	11	44
Contemporary Non-Immigrant	14	31	45
Grand Total	74	60	134

Table 2

2016	Framing as Youth Culture		
Generation	No	Yes	Grand Total
Events	103	47	150
Legacy (before 1970s, Chinese)	8	1	9
New Immigrant (after 1970s, immigrant owned)	4	7	11
Contemporary Non-Immigrant	69	71	140
Grand Total	184	126	310

The tables above examine how the posts advertised businesses in different generations in terms of framework for the youth. To be advertised towards the youth, the BID framing had to include a caption of how a business is fun or trendy. An example of this would be the many events advertised. In 2016, about a quarter of the events were categorized as youth. 2016 marks the beginning of the BID's efforts in creating events like Chinatown Summer Nights that bring in a younger audience to enjoy their concert music and street-vendor foods. These events are not catered to the older generation, especially the older Chinese residents. In creating a space where the younger generation can gather to enjoy events, older residents who do not attend such festivals get excluded. Professor Hom observed the general demographic of people attending Chinatown Summer Nights, noting that the crowd was "families with young parents, groups of friends, and young trendy hipsters" (Fieldnotes, August 2015). Another observation that clearly depicts the target audience was Professor Hom noticing that "three hipster 20 somethings crossing the street" towards an event and "three elderly Chinese people walking in the opposite direction" (Fieldnotes, June 2015). This observation captures the nature of the BID, showing how it points its attention towards the youth at the expense of the older residents.

Though there is not much of a distinction across the two years, especially in terms of the older businesses, it is still clear that the BID's main audience is the younger demographic. In Table 2, a majority of the contemporary businesses are getting framed as businesses that the youth should go to, like vintage pop-up stores. It is also usually the younger generation that are browsing Instagram for food and shop recommendations.

There are many instances throughout Instagram where drinking, karaoke and other events are mentioned, and these events tend to be ones that the youth participate in. In both tables, it is clear that a significant portion (a little under half) of the posts are targeted towards this demographic, providing a skewed bias of the BID as majority of the residents in L.A. Chinatown are not that young.

"Foodie" culture

Another way that the BID markets its neighborhood is through the lens of "foodie" culture. Foodie culture is defined as a trend that demands good food for the purpose of pleasure and enjoyment (Livingstone, 2019). Since its rise in popularity in the later 2010s, the BID has taken this idea and emphasized this in their marketing.

Chart 1
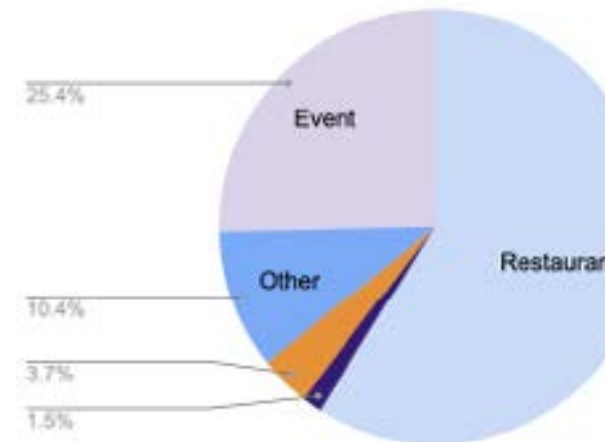
Chart 2

The data collected looked at the pictures on Instagram to see if the BID was encouraging its audience to visit Chinatown to enjoy the food there. In 2016, only 22.2% of the posts were of restaurants, however this spiked in 2020, where 70.1% of the posts were of food. Again, this could have been due to the pandemic, as more restaurants need advertisement in order to garner business. By promoting the food in the neighborhood, the BID paints Chinatown as an area that people should visit to get food that they would enjoy. It should be noted that events were counted in the pie chart, and certain events are not mainly for food, so there could be some overlap.

Table 1

2016	Framing as "foodie"		
Generation	No	Yes	Grand Total
Events	116	34	150
Legacy (before 1970s, Chinese)	3	6	9
New Immigrant (after 1970s, immigrant owned)	1	10	11
Contemporary Non-Immigrant	6	134	140
Grand Total	126	184	310

Table 2

2020	Framing as "foodie"		
Generation	No	Yes	Grand Total
Events	33	1	34
Legacy - before 1970s		11	11
New Immigrant (after 1970s, immigrant owned)	3	41	44
Contemporary Non Immigrant	4	41	45
Grand Total	40	94	134

When cross examining the posts of food with the various generations of businesses and events, most businesses were framed with this trend in mind. In Table 1, 150 posts regarding businesses (this excludes the events) were framed as foodie whereas only 10 were not, illustrating how an overwhelming number of businesses were advertised in this way. This trend follows into 2020, where foodie culture is more prevalent than ever. Of the 134 posts, 93 of them were businesses that were framed as foodie and only 7 that were not. Looking at the businesses generationally also provides insight. The BID mainly promoted contemporary or new immigrant businesses as foodie. The older restaurants mentioned may have already been established enough with loyal customers to not really need this sort of advertising. In 2020, there were also more new immigrant businesses mentioned, so it could be that the BID has made a step back in promoting trendy restaurants. This does not affect the fact that a majority of the businesses promoted were still through a foodie lens.

Using this data, we can infer that the BID wanted to use a popular trend to market its neighborhood, emphasizing one sort of business over the other. This can have a negative effect on the neighborhood because shops that may not necessarily be restaurants are getting neglected and losing advertisement value, which can drive them out of the neighborhood and further gentrification.

Trend Towards a Non-Asian demographic:

Table 1

2016	Framing as Asian		
Generation	No	Yes	Grand Total
Events	118	32	150
Legacy (before 1970s, Chinese)		9	9
New Immigrant (after 1970s, immigrant owned)		11	11
Contemporary Non-Immigrant	53	87	140
Grand Total	171	139	310

Table 2

2020	Framing as Asian		
Generation	No	Yes	Grand Total
Events	23	11	34
Legacy (before 1970s, Chinese)	2	9	11
New Immigrant (after 1970s, immigrant owned)	1	43	44
Contemporary Non-Immigrant	18	27	45
Grand Total	44	90	134

Another lens used to observe the BID marketing on Instagram was if the business was considered Asian or not, meaning that either the business was founded by someone Asian or if the business served Asian goods. Table 1 shows that 107 of the posts made for businesses are in fact Asian, with a majority of them being contemporary. It is the same in 2020, where 79 of the businesses posted are also Asian. However, there is still a significant number of posts that are not framed this way. The businesses usually promoted as non-Asian tend to be contemporary, such as Burger Lords or Howlin' Rays. This trend follows into 2020 as well, where older stores were framed as Asian and newer stores are not. This could speak to the changing look of the neighborhood in that the BID seeks to start new businesses that are not primarily Asian.

It is mentioned in Professor Hom's observations that the trendier restaurants next to Vietnamese and Cantonese restaurants are popping up, specifically ones like a "Scoops, a trendy coffee and ice cream shop. Chego, Pok Pok, and a ramen place" Fieldnotes, January 2015). These restaurants are diverse in their cuisines, which indicates a transitioning demographic in Chinatown and potential gentrification. When a BID board member was asked during an interview with Professor Hom what he made of the changing culture in Chinatown, he claimed that "the 'keeping Chinatown Chinese' rhetoric that has been happening and he says he fundamentally has problems with it" (Fieldnotes, August 2016). He believes that this is not gentrification, but rather is a method of promoting economic growth in the neighborhood.

Table 3

2016	Ethnic Business?			
Generation	N/A	Chinese	Non-Chinese	Grand Total
Events	148	2		150
Legacy (before 1970s, Chinese)		9		9
New Immigrant (after 1970s, immigrant owned]		10	1	11
Contemporary Non-Immigrant	1	51	89	141
Grand Total	149	72	90	311

Table 4

2020	Ethnic Business?			
Generation	N/A	Chinese	Non-Chinese	Grand Total
Events	33	1		34
Legacy (before 1970s, Chinese)		9	2	11
New Immigrant (after 1970s, immigrant owned]		40	4	44
Contemporary Non-Immigrant	1	22	22	45
Grand Total	34	72	28	134

In a closer examination of the Asian businesses, the shops can be broken down further in terms of whether they are ethnically Chinese, or not. The results are depicted in Table 3 and 4, where in 2016, 90 of the businesses posted on Instagram were non-Chinese, all but 1 being contemporary. This speaks to the goals of the BID at the time and how the BID has contributed towards gentrification. If the BID is not promoting ethnic businesses, especially older ones that have a higher possibility of being displaced, then these restaurants and shops will run out of business. Instead of having a majority of its Instagram promoting the ethnic culture and food of Chinatown, it brings in a plethora of other cuisines that do not represent the neighborhood's residents. The shift in 2020 towards more Chinese businesses is a good indication of the BID's changing goals amidst the pandemic. As anti-Asian sentiment grew, the BID found it important to promote authentic restaurants and shops, and to encourage economic growth in this area.

Events are also imperative towards the data collected, as many posts are dedicated to events such as giveaways where individuals had to go on a scavenger hunt around Chinatown or Chinatown Summer Nights. While it was not possible to hold these events during the pandemic, a significant amount of posts in 2016 were of such events. These events usually had little to do with Chinatown or its culture, but rather was a method employed to bring people in for economic reasons and engagement.

Conclusion

The present findings indicate that the LA Chinatown BID marketed the neighborhood on their Instagram in order to gain interest in the public. Specifically, they targeted the youth, steered the conversation towards foodie culture, played into the photo aspect of the neighborhood

and expanded their marketing to non-native businesses. While COVID-19 brought on a trend in marketing, where older local businesses are discussed more, the posts still skewed towards the younger demographic with photo opportunities and foodie culture.

The implications of BID marketing are clear in their bias towards the younger demographic. Instead of trying to help local residents and businesses in economic growth, the BID merely uses newer, trendier restaurants and events to target a different audience while still gaining the money. The youth-oriented outlook can be a driver of gentrification, taking the spotlight off of a majority of the resident's needs and instead highlighting another group that is not represented in the area. The many events mentioned are targeted towards the younger generation so that they can participate in a "live-work-play" narrative (Li, 2015). These Night Markets are a good source of revenue for the neighborhood, but do not cater to it. Many of the residents there do not participate in these events and are even mystified by its occurrence. The new phenomenon occurring in the growth of trendier shops that appeal to a younger generation that ultimately phases out the older traditions and culture (Pottie-Sherman, 2013).

The findings on photo opportunities and the role of aesthetics presented in 2016 is broadly consistent with the idea that the BID generates economic interest through photo promotion. By emphasizing the neighborhood's distinct oriental characteristics, taking pictures of aesthetically pleasing food, and creating a clean space, the BID allows the neighborhood to feel fun and new so that the target audience is interested in visiting. The visitors can enjoy food and shop and also take pictures to post at the same time. However, this artificial image of the neighborhood robs residents from telling their true stories, especially in regard to the communities' struggles that should be addressed (Henderson, 2000). It also prevents many businesses that do not participate in trends and aesthetics from gaining visitors, as the visitors mainly go to the trendy spots promoted. The economic growth here occurs in these events and restaurants that are not necessarily native to the neighborhood, which can drive away older shops and residents that cannot afford to live in the neighborhood (Li, 2015).

Other marketing tactics mentioned were the promotion of foodie culture and a mixed heritage concept. However, these are not too prevalent in the BID's marketing. Many posts are foodie in nature because they are promoting restaurants and drinks, so it does contribute towards the gentrification narrative. While foodie culture is a new phenomenon, many Chinatowns boast food, so this is not new. With that, a majority of the businesses are still Asian, often more Chinese than not. Especially with coronavirus, more businesses are ethnically Chinese and demographically Asian.

Looking forward, there are future studies that could continue to inform the discussion on gentrification, especially in ethnic neighborhoods. Future research can extend explanations of the different generations of businesses that are promoted. As seen in this paper, most businesses are contemporary ones, and I don't really go into the discussion of why contemporary businesses are more desirable. Perhaps it could just be that the older stores have a set customer base already, but either way, this would be a fruitful source of information. Further attempts to examine the events promoted in the BIDs would also prove important. This paper focused primarily on businesses rather than events, but a large

portion of the posts were towards promoting events. It would also be interesting to look at the longer-term impacts of COVID-19 on the marketing goals of BIDs. Considering the shift towards promoting local businesses, BIDs in urban Chinatowns or ethnic spaces may be shifting in response to economic concerns about supporting Asian American communities that arise from this pandemic.

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Lin   **Team LV Bottle I Sustainable and Reusable Packaging**
Stephen

Project Summary

In the new circular economy where brands are seeking sustainable packaging solutions that can be easily recycled, refilled, and reused; Team LV Bottle developed a patented zero waste consumer package and business model that allows brands to achieve their sustainable packaging goals to eliminate contaminated recycling that sends millions of tons of packaging to landfills.

Contaminated Recycling is when packages are not properly cleaned, such as when food and cosmetic residue remains in a plastic container when recycled. A single contaminated package can end up sending an entire batch of recyclables to landfill.

Team LV Bottles utility patented zero waste packaging provides brands, consumers, and waste management facilities the access needed to eliminate contaminated recycling within all forms of consumer packaging.

Our packaging achieves what most consumer packages on the market cannot, 100% accessibility, and we serve consumer product brands seeking disruptive sustainable packaging solutions to address this problem.

Within the past year we've interviewed top executives from major brands such as Ulta, Disney, and Tricorbraun, to name a few, from which they mutually expressed interest in testing our patented zero waste packaging once its functionality is market ready.

During these interviews with major brands we learned that they were all seeking a disruptive "zero waste" sustainable package that the market has yet to see, and they were also mutually impressed that our packaging also addresses the nagging universal problem that consumers experience with their inability to access the "last drop" of their product within the markets standard consumer package.

Team LV Bottle was able to position itself to attract the interest of these major brands through our efforts in developing CAD and animated bottle designs, 3D prototypes, pitch deck, proposals and a website to provide a clear vision of what our patented zero waste packaging can achieve.

Introduction/Background/Motivation

Because of its complexity in shape, size, and dispensation, consumer packaging is one of the most complicated forms of packaging to reuse or recycle. From low- to high-end products, in categories of food, personal care, home improvement, and more, there is currently no viable solution for accessing the "last drop" of product to eliminate waste.

First, Packaging is not regularly reused or recycled: More than 140 million metric tons of packaging is trashed each year, representing as much as $120 billion in lost value to the global economy. (World Economic Forum, 2016) In the United States, 25% of recycled materials are sent to landfill each year, often because they are contaminated with residual product. (New York Times, 2018)

Secondly, overwhelmed with packaging, landfills disproportionally contribute to climate change: In the United States, 23% of municipal solid waste is packaging and landfills are the third largest source of human-related methane emissions — a potent greenhouse gas. (EPA, 2020)

Third, consumers aren't getting their money's worth. Every drop wasted is a dollar wasted — literally, in the case of high-value products like cosmetics — and brands regularly overfill packaging to compensate. For example, as much as 25% of high-end cosmetic products are inaccessible to consumers because of packaging, representing $25 in lost value. (Consumer Reports, 2017)

Reusability and accessibility are critical to truly sustainable packaging. Team LV Bottles utility-patent approved packaging features can be incorporated into any product design, regardless of shape, size, material, or dispensing method.

Team LV Bottles innovation facilitates easily accessible packaging for companies looking to "close the loop" on packaging, and for the first time ever, lets consumers access the "last drop" of a product and fully rinse the package, promoting the reduction of contaminated recycling, if refill and reuse is unavailable.

Through our customer discovery and interviews with such brands as Ulta Beauty, Disney, and TricorBraun, we learned that these consumer packaging brands, along with other major brands, are committed to having their packaging achieve 100% recyclability and reuse by 2025.

Through our customer discovery research and the current level of interest within our patented zero waste packaging from major brands, we've concluded that Team LV Bottle's innovation addresses a valid environmental problem that our target market, consumer brands, are seeking to eliminate from their supply chain by 2025.

Methods

Customer Discovery:

As more major brands and manufacturers are adopting new sustainable packaging initiatives, we reached out to a few within the beauty sector that we felt could benefit from our patented zero waste packaging.

Brand #1: Ulta Beauty

In July, 2020, we came across an article that ULTA Beauty was starting a

sustainability initiative to have 50% of its packaging reusable, sustainable, and producing zero waste by 2025. From that article we instantly knew that our packaging would complement their initiative so we contacted Ulta Beauty's Director of Corporate Strategy to gage her interest. She was excited to discuss this further and we had a zoom meeting from which we asked the following questions:

• What inspired their sustainability initiative?

• When will their sustainability initiative go into effect?

• How many of their 1256 stores will adopt their sustainability initiative?

• Who are they currently partnered with to launch this initiative?

• What type of packaging are they using?

• Does their packaging provide consumers 100% accessibility?

• Will their reusable packaging be easy to clean in order to be reused?

• How will they reclaim their packaging from customers?

• How will they clean the packaging that they reclaim? and how will they dispose of any residual waste that is left in the packaging?

Brand #2: Disney Imagineers

During a tour of Disney Imagineers arranged by the Hatchery, we had an opportunity to participate in a great roundtable meeting with Bob Weis, President of Disney's Imagineers, along with his Senior Imagineers, a month before COVID hit. There was a great synergy, and their Senior Lead Designer, Matias Cena, who loved our innovation, and we asked him the following questions:

• How could our innovation be applied to any of Disney's products?

• Is the Disney Imagineer Department involved with Disney's consumer product designs?

Mr. Cena's response was, and we quote:

"As far as a collaboration with Disney, I think once you have the concept down it could easily be incorporated into a product that is sold in the parks, especially since it has a sustainable and reusable value. Maybe something that could be sold on the Animal Kingdom Park or on our Glendale campus here in LA. Let me know how you guys progress and I can put you in touch with someone from consumer products."

Brand #3: TricorBraun

TricorBraun is a packaging manufacturer for such major brands as Unilever and L'Oreal, and our Board Advisor who worked for Unilever for 13+ years, suggested that we contact TricorBraun for prototype development and manufacturing quotes. However, after talking to the Vice President at TricorBraun we discovered that they could not provide any prototype and manufacturing solutions for us but they could become a potential customer.

Per TricorBraun, the majority of packaging that they supply for Unilever is from third party manufacturing companies so they do not manufacture in-house. However, the VP mentioned that our innovation is "revolutionary" and ahead of its time, and if we develop a commercially available version of our packaging then he would have a lot of customers that he feels will adopt it. With this new information we asked him the following questions:

• Why would TricorBraun's customers adopt our patented zero-waste packaging?

• What sectors are TricorBraun's customers that would be interested in our packaging?

• What solutions have these customers already adopted?

• Why has there not been a solution provided?

• How big is TricorBraun?

• How large is TricorBraun's customer base?

Results

Brand #1: Ulta Beauty

From the questions and answers conducted with Ulta Beauty, our team came to the hypotheses that for Ulta there is one unforeseeable additional form of waste that they have to consider within their new sustainability initiative which is "how will they dispose of residual waste left within their reusable packaging". Ulta's Director of Corporate Strategy did not have an answer for that as they are using the waste management platform Loop by TerraCycle to handle their cleaning process for their reusable packaging.

The meeting concluded with an interest from Ulta's Director of Corporate Strategy wanting us to have a second meeting with Ulta's private label team to discuss the possibility of doing a trial run of our packaging.

As a team we've came to the theory that most major brands see sustainability as just changing the material of packaging from plastic to aluminum or glass, but they are

not looking deeper into the root cause of the packaging's functionality, which limits its ability to be sustainable as well, especially if that aluminum or glass packaging still has remaining content within that packaging. However, having remaining content even within packaging that has the most sustainable material will still create another form of waste that will have to be landfilled if recycled, which is considered contaminated recycling.

Brand #2: Disney Imagineers

From this experience we discovered that there are multiple innovative outlets that our sustainable packaging could be applied to. Our zero-waste packaging design does not have to just be limited to sustainable consumer products but it could also be applied to promotional gift items and unique theme park souvenirs, which provided us with valuable insight and discovery into new sectors that we have not previously considered for our patented packaging.

Brand #3: TricorBraun

Given the answers from TricorBraun to the questions listed above, we discovered that most major brands do not develop their packaging in-house, they use third party suppliers who also do not develop their packaging in-house, they use third party manufacturers.

We also discovered that brands have been seeking solutions for years for packaging with narrow openings to allow consumers 100% access to their products, especially within high-end make-up products. When we asked the VP of TricorBraun what solutions that his brands customers came up with in order to make up for their consumers not being able to access the "last drop", he replied that "they would mail the consumers an additional small sample package to make up for the loss of the customers not being able to access the last drop of such make-up products as high-end foundation".

From this customer interview we learned that most brands are seeking solutions that our patented zero waste packaging provides, but they need to see it commercially available first before adopting.

Conclusion

Based on these customer discovery's and other meetings we had with other companies we decided to change our plan. Initially in the beginning of this project we created prototypes and design specifically for LOOP. However, through meetings with our mentor and advisors from the Projects Hatchery we realized it wasn't the best use of our resources nor time to only focus on one brand. We learned that although our packaging is for premium packaging it still needs to be cost competitive. Also, many companies wanted a proof of concept specific to their company, which would be time consuming an inefficient. This is when we decided to pivot and use our resources to target a broader audience. We created a website and a video in which showcased

our designs, which allowed companies to visualize our innovation without an actual prototype. This allowed us to talk to more companies that gave us more insight to how we can incorporate our packaging with their business. Thus, prompted us to talk to manufacturers to receive quotes, while allowing us to perfect our design to be manufacturable.

Unfortunately, when the Covid-19 pandemic hit we had to make some adjustments. Since we could no longer use the school resources to create prototypes, we purchased our own 3D resin printer to continue the momentum on our research and development.

Still keeping in mind what we learned from talking to consumer product brands, we shifted our focus on solidifying a proof of concept that would appeal to multiple needs of these organizations.

We believe that if we did not pivot, we would never be able to reach our goals. Since we were so focused on LOOP it prevented us from learning and expanding to other companies. Therefore, the pivot allowed us to be closer at reaching our goals of incorporating our packaging with major brands. For example, now we are in talks with ULTA for a potential to work with their private label team.

Our project can even be expanded; it can be applied to other branches of consumer packaging. We have actually experienced this when we had a potential collaboration with a hydro farm company that showed interest in our designs. This is when we realized that our designs don't have to be strictly for consumer packaging that comes in a bottle, but rather it can be anything that we can apply it to. Our project can even be applied to our daily lives, like shopping for groceries, something we never even thought of.

For those who want to pursue something similar to our project, I would suggest to make sure you know your audience. Since the category that our project is targeting is niche, it can be difficult to find the right people for customer discovery. However, that doesn't mean they aren't out there, but rather you need to know what you are looking for. Also, one should always keep an open mind when it comes to their target market and business model as we've learned and realized that things do not always turn out as you would expect.

Being new to developing a business model, engaging in customer discovery, along with strategizing product development, there was an enriching hands on experience that was gained beyond that of what you'd receive in the classroom, and for that we're grateful for the experimental journey that the Hatchery Program provided.

Team LV Bottles Design Evolution by Stephen Lin

Below are just a few of the multiple designs that Team LV Bottle developed in Stage 3, and in which we are still working on to improve as we enter Stage 4.

Design #1
Team LV Bottle's beginning design in Stage 3.

Design #2
Evolved into a sleeker design after customer discovery feedback.

Design #3
Moved onto this design to improve lock security.

Design #4
Design 3's locks were too difficult to open at once, so below is are new working design for Stage 4, which also needs improvement as it has failed our current drop test.

Team LV Bottles Website

As we began to attract interest from brands and receive sustainability and minority enterprise certifications, we decided it was prudent for Team LV Bottle to establish a business name, which became ReCIRC, along with launching a website. Below are screenshots of our site.

RE CIRC
YOUR SHOWER

Get the "last drop" of body wash, shampoo, conditioner and beyond.

RE CIRC
YOUR BEAUTY

Get the "last drop" of moisturizer, face wash, make-up and beyond.

RE CIRC
YOUR KITCHEN

Get the "last drop" of ketchup, mustard, dressing and beyond.

RE CIRC
YOUR CRAFTS

Get the "last drop" of glue, paint, sealant and beyond.

RE CIRC
YOUR AUTO CARE

Get the "last drop" of oil, wax, paint and beyond.

RE CIRC
YOUR WATER BOTTLE

Access your water bottle to easily wash, dry, and even place in the dishwasher.

RE CIRC
YOUR BABY BOTTLE

Access your baby bottles to easily wash, dry, and even place in the dish washer.

CONSCIOUS CONSUMERS

Consumers are demanding sustainable packaging solutions.

83% of millennials are demanding brands to be sustainable.

75% of millennials are willing to pay more for sustainable products.

Nielsen Report, 2019

RECIRC's patented zero waste packaging is the first of its kind and can be applied to **any shape, size, material and industry.**

RE CIRC®

BUSINESS OPTIONS

Certified B Corporation

1. License

RECIRC's utility patent approved zero waste packaging can be licensed for domestic and international use by any brand, manufacturer, or sales agency.

2. Manufacture

RECIRC can joint develop or provide manufacturing options for brands seeking to use its patented zero waste packaging solution.

3. Franchise

RECIRC's domestic and international utility patents, along with its trademark, can be franchised by entrepreneurs and manufacturers seeking to enter the new 'Re' economy with rights to a disruptive, zero waste, reusable, refillable packaging innovation.

HOME   PATENTS

U.S. PATENT APPROVED

RECIRC'S United States approved utility patent includes International Patent protection within over 75% of the worlds top GDP territories.

**AFRICAN AMERICANS OWN
LESS THEN 0.3% OF PATENTS
IN THE UNITED STATES**

Information Technology &
Innovation Foundation Survey,
2017

RE CIRC + Certified B Corporation

Certified B Corporations are a new kind of business that balances purpose and profit. They are legally required to consider the impact of their decisions on their workers, customers, suppliers, community, and the environment.

This is a community of leaders, driving a global movement of people using business as a force for good. **RECIRC** is the world's first Black owned sustainable packaging B Corp, and maintains a leading impact assessment score **(97.3)** among major brands.

IMPACT

**ENVIRONMENTAL
WASTE**

120 Billion

The cosmetic industry produces 120 billion packaging units every year across the globe.
ULTA, 2020

25% WASTE

Personal care and beauty products account for a third of all landfill waste.
EPA, 2017

100,000 TONS

Of recycling is sent to landfills every year because of the remaining content left in the packaging.
RePAK, 2016

**RESIDUAL
PRODUCT WASTE**

Millions of tons of product is landfilled each year because it remains inaccessible in packaging.

MIT, 2014

An example of what consumers currently lose with every purchase...

$20.00
Moisturizer

$12.00
Primer

$50.00
Foundation

REDUCE WASTE WITH RECIRC

RECIRC reduces contaminated recycling, promotes refill and reusability, and for the first time ever gives consumers their monies worth by accessing the "last drop".

#Commit2Inclusion

A percentage of **RECIRC's** profits will go towards its **Commit2Inclusion Fund**, fostering diversity in sustainable innovation and entrepreneurship while supporting social + environmental justice.

RE CIRC

RECIRC is a certified **Minority Business Enterprise** and **B Corp** that achieves 10 out of 17 sustainable development goals.

The team also works with Cal Poly Pomona's Engineering Department for research and development.

RECIRC possesses a combined **133+ years** experience in solution based thinking within CPG, supply chain, brand management, engineering, and sustainability.

Sebastian Velmont
Co-Founder | CEO

Rashon Velmont
Co-Founder | COO

Cherlika Brown
Co-Founder | CMO

Stephen Lin
Chief Design Engineer

Rachel Sarnoff
Strategic Advisor

Fontaine Lloyd
Strategic Advisor

Loeffler
Meaghan

The Effect of Median Judges on Supreme Court Legitimacy

Abstract

While perceptually separate from the other two branches of the federal government, the Judicial Branch's Supreme Court is viewed as an institution abstaining from politics and serving as the largest check on the Executive and Legislative powers. However, intermingling of these branches raises concerns of association that the appointments and the Justices' rulings, post-appointment, are politically aligned with the ideological subscription of the appointers. As a result, close attention to public opinion on the levels of support towards specific rulings, known as specific support, and support towards the institution, or diffuse support, is necessary to be evaluated in a highly polarized environment but with the existence of a tie-breaking median Justice. The objective of this study is to examine the extent to which public support, both specific and diffuse, varies given respondents' answers to mock Supreme Court decisions with and without the vote of a moderate Justice. The results of this study find that individuals are more likely to be in favor of the decisions that host a Median Justice especially when the decision falls in line with their personal ideology. However, the Median Justice plays a minimal role for individuals when decisions are not in line with their beliefs, additionally the interaction with diffuse support might be influenced by their support for specific decisions. This research adds to previous examinations of public support for the Supreme Court and analyzes whether median justices, included in ideologically-based decisions opposite to respondents, affects the level of specific support for the Court.

Introduction

The Supreme Court stands as a symbol of impartiality and justice unparalleled to other federal institutions in the United States. However, as argued by many, including Justice Kagan in 2018, the confidence citizens have in the Court is largely contingent on the belief that Justices are separate from politics. When the two merge, as Kagan states, the Court becomes perceptually partisan in its decision making, the risk of losing citizens' support is incredibly high (Millhiser 2018). The potential for a reduction of faith in the Supreme Court's decisions and appointments can greatly influence the efficacy of the work the institution produces. The confirmation of Brett Kavanaugh, appointed by President Trump, was met with public and congressional outrage. With accusations of assault against the soon to be Justice met with counter-allegations of Democrats attempting to keep conservative Justices off the bench, the appointment seemed to fall on a political divide (Irons 2019).

Divisions in partisan-led support for specific Supreme Court members and overall approval of the court vary. Following the approval of Justice Gorsuch and the nomination of Kavanaugh, 72% of Republican respondents approved the court in comparison to 38% of Democrats, indicating a partisan split (Irons 2019). Depending on the Administration, their appointments, and the decisions or policies that make their way to the Supreme Court to be found constitutional or unconstitutional, the approval from the citizens is in flux. Previous literature argues that the differing levels of support, specific to the decision or long term in

its assessment of institutional legitimacy, are met with a whole host of mitigating factors. Considering the findings of previous scholarship that indicate the perceptual political or ideological alignment of Justices reducing the faith of citizens' confidence in the institution or the legitimacy of the decisions produced, an empirical analysis controlling for the swing vote can be conducted. This analysis can better assess the influence of ideological alignment and political alignment on citizens' confidence in the Supreme Court. This research specifically delving into the existence of the Median and the influence on public opinion and Supreme Court legitimacy will aid in the understanding of what judicial and Supreme Court legitimacy looks like in a currently highly polarized and politically contentious United States.

In this study, we argue that the existence of a median Justice in a Supreme Court holding can influence the level of public support for the decision and overall legitimacy of the Supreme Court. More specifically, when individuals are not ideologically aligned with the Supreme Court decision, they are more likely to support it when the Median is the swing vote in the decision. Additionally, they are more likely to feed into the idea that with the existence of a truly non-partisan Justice, the Court becomes more legitimate as a federal institution. As a result, in line with Justice Kagan, the existence of the moderate Median Justice will have a positive relationship on legitimacy overall. However, when individuals are met with decisions they ideologically agree, the existence of this moderate Median does not matter in questions of Supreme Court legitimacy.

To test this argument, we conducted an experiment on Amazon's Mechanical Turk to empirically assess the effects of the existence of a moderate Median Justice on public willingness to support specific Court decisions. The findings indicate that the existence of a moderate Median sitting on the decision does influence respondents' overall perception of Court legitimacy especially when the individual is ideologically aligned with the decision that is presented to them. Additionally, the congruence of personal and decision ideology combined with the existence of the Median in the holding increased the likelihood of the respondent supporting the decision.

Median Judges and Court Legitimacy

As one of the highest respected branches of the United States Federal Government, the judiciary has been viewed as a separate but just as important, if not the most important, branch due to its apparent divide from the otherwise polarized political atmosphere. While justices are supposed to remain as impartial as possible, individuals interpreting the outcomes of landmark and even less contentious cases take into account that justices are held to a different standard than otherwise elected officials. However, in the years following the contentious Bork defeat and Thomas victory in attaining a seat in the highest court in the nation, questions as to whether public opinion has played a role in determining who is appointed acknowledge that the general public may influence this attainment (Gibson and Caldeira 2009). Considering this case, in particular, has led scholars to assume that public opinion may influence the greater legitimacy struggles faced by the institution, in turn, affecting the overall acceptance of rulings by the justices despite its otherwise partitioned political existence.

To better operationalize the level of confidence, or support, individuals have for these institutions, two measures are proposed. The first measure of confidence is known as diffuse support and the second being specific support. Authors find that diffuse support indicates overall support in the legitimacy of the Supreme Court, or a high court, whereas specific support deals with individuals' support after specific decisions have been made by the justices (Gibson et al 1998, Baird 2001, Gibson et al 2003, Gibson et al 1992, Gibson et al 1995). While some scholars have found that loyalty to the institution remains high, the fluctuation of specific support can depend on the strength of the individual's ideological beliefs and belief in the court to remain impartial on particularly contentious cases. Though, it is generally recognized that loyalty to the institution overall can exist without confidence in it (Gibson et al 2003). While this makes diffuse support most important in understanding the loyalty individuals have to the output of the court, it notes that specific support, in flux, may be easier to measure given the particular design scholars undertake (Gibson et al 1995).

Adding to these levels of diffuse and specific support is the social reinforcement given to individuals who may know more or less about the court. Previous scholars have cited this phenomenon as positivity bias. This bias is associated with receiving positive messages about courts and the law increasing legitimacy directly among constituents (Gibson et al 1998, Gibson et al 2014, Gibson et al 2009). While some tend to find that this is able to be recalled by exposure to judicial symbols, activating a positive connotation with the courts and legal proceedings, others find that this positivity bias may arise prior to activation and only be associated when seeing decisions, without symbol exposure (Gibson et al 2014). Strikingly enough, Gibson, Lodge, and Woodson find that the exposure to these symbols in tandem with a decision an individual is likely to find contentious can influence their level of acceptance with particular rulings (2014). The general consensus remains that symbols, or activation of the positivity bias generally, increases the loyalty and acceptance of particular decisions though it may not be as striking as previous scholars have predicted.

While biases and long-term diffuse support have been cited as possible explanations as to why individuals are more or less inclined to accept specific rulings, the content of the rulings has also been a point of academic research providing alternative reasoning towards specific acceptance. Many of these specific studies analyze whether providing information about particular judges and the citations in their decisions influence whether an individual finds one decision or another to be more legitimate (Menounou 2017, Farganis 2012, Bonneau et al 2016, Baird 2001). Authors have generally agreed on the findings that when these reasons for the decision, such as citing external sources beyond domestic courts or decisions utilizing more legalistic jargon, are in tandem with what the citizens want in particular, it increases support (Menounou 2017, Farganis 2012, Bonneau et al 2016, Baird 2001). Because justices and the courts are associated with legalistic measures that individuals may not understand but find necessary to respect, their likeliness to not accept rulings remains low. However, the outlier in this instance may be found in the communities directly affected by the outcomes in which they find that the decision is extrajudicial (Bonneau 2016). Though, when looking at conventional methods of decision making and legalistic backing to decisions, the public is more likely to pay attention to the reasoning and the legitimacy of the court is increased as a result (Farganis 2012).

Questions of legitimacy are incredibly important in consideration of the highly contentious cases that may reach the courts. Adherence to and acceptance of rulings can influence the outcome of landmark cases as the final ruling is understood as the last interpretation of the law and constitutional provisions. One of the hallmark cases concerning the presence and effect of legitimacy on acceptance of the ruling held was Bush v Gore (Gibson and Caldeira 2009, Gibson et al 2003). Due to the ruling arguing against a recount of the Presidential votes in a state with uniquely different measures in casting ballots, and operating under the assumption there would be an entirely different outcome to the election, this ruling, in particular, was seen as the largest threat to Supreme Court legitimacy. Gibson, Caldeira, and Spence question whether confidence is an adequate measure of this legitimacy following this case in particular (2003). Utilizing General Social Survey answers from 2001, authors Gibson, Caldeira and Spence recognize constraints in the wording of the survey questions and in their ability to be able to test whether approval of specific decisions has a long enough half-life to affect the legitimacy of the institution at all, or whether it comes from a higher trust (2003). The study attempts to solve this by asking about the confidence in specific actors, overall approval, support for the Court, specific support and loyalty to the institution. The study finds that individuals are typically in favor of the court and are loyal to it regardless of decisions and the favor they hold (Gibson, Caldeira, and Spence 2003). When the court has long standing legitimacy and loyalty as a byproduct, specific cases alone are unlikely to make a large impact on the overall legitimacy. The ability to utilize confidence as a measure has aided the study but should be controlled for short-term and long-term effects and the half-life scenario presented by the authors prior.

This finding of a lack of strong fluctuation in support is also laid in the groundwork produced by earlier studies. As indicated by Gibson and Caldeira's previous study using responses from the National Social Survey, they agree with the aforementioned findings. While political values may predict attitudes towards particular cases, the ebbs and flows of support are not incredibly different on a case by case basis (Gibson and Caldeira 1992). Though the study does note that opinion leaders, conservative or more liberal judges, ruling in non-predictive ways may influence the acceptance of particular cases by the public at large.

Understanding that justices may be removed from some level of the political process, it is clear that they are not infallible when it comes to biases that may exist beyond their scope of deemed impartiality until cases are presented. Due to this, previous researchers have found that differing levels of support for the court by citizens may exist when particular judgments are held that may not agree with their own personal biases (Gibson and Caldeira 1992, Gibson and Caldeira 1995). In a more recent study, Bartels and Johnston posit the notion that individuals may perceive Supreme Court decisions as being legitimate or illegitimate, and place this assumption on the body of the court as a factor for determining legitimacy (2013). Subjective ideological disagreement is coined as providing individuals with this bias against or for the institution based on whether it agrees with their specific ideological alignment. Arguing that politics and ideological divides are accepted as inherent characteristics in this system moves the study to utilize public polling and interviews conducted in 2005 (Bartles and Johnston 2013). With this taken into account, individuals are found to believe that the court is no longer strictly conservative as prior research articulated. Additionally, the lines between politics and the court have been blurred and the acceptance

of ideology making its way into decisions is accepted as commonplace and objectivity is impossible to attain in decisions (Bartles and Johnston 2013). Legitimacy and respondents' personal ideologies are positively related as liberal courts are seen as uniquely legitimate by liberal identifying individuals.

This is coupled with findings that the public is becoming more attentive to the court's rulings, and confirmation biases of political alignments are becoming increasingly common among those concerned with the rulings in particular (Gibson and Caldeira 2009). In an attempt to answer what the effect of politicized confirmation battles on the legitimacy of the Supreme Court and the broader court system in the United States is, authors Gibson and Caldeira, rely on aggregate time-series data from the General Social Survey, small collections of individual surveys, media polls, simulations, and studies on the individual level change to see if the controversy over the nomination of Justice Alito reduces the overall legitimacy of the court (2009). The authors find that controversial appointments "wake up" dormant attitudes about the reliability of the court to be distinct from political ideology, harming the legitimizing symbols of impartiality the court is otherwise associated with. This is viewed as potentially harmful to the impartial mindset associated with it and, by doing so, can reduce the faith of citizens more knowledgeable about the court's confidence in legitimate rulings (Gibson and Caldeira 2009).

While long-term legitimacy for the Supreme Court seems to remain relatively stable, the support of specific case decisions may be in flux. Recognizing the highly politicized atmosphere the court has gained has placed higher importance on the association of legalistic and neutral characteristics of the Court with their decisions. Understanding confirmation bias led by ideological alignment, the positivity theory offered by previous scholars, and positive connotations being held with purely legalistic rulings raises the concern as to whether judges associated with being "median" on the court can influence the level of acceptance of decisions among citizens. Utilizing, perhaps, less ideologically charged rhetoric in their decision making, and serving as swing votes in deciding cases, the importance of their holdings on cases may be able to increase specific support among those who would not otherwise agree with the case decision.

The previous theoretical approach fails to take into account this analysis of the influence of median justices contributing to ideologically polarizing Supreme Court Decisions. Previous studies stop at the assessment of respondents' ideological beliefs and their willingness to accept decisions made by the court and whether this interacts with the level of diffuse support. We argue that perception of ideological alignment in the decisions presented to respondents, as found previously, can influence the levels of specific support recorded. Additionally, in finding this specific support to be in flux, we expect to find some effect on this level of support if the individual may not ideologically agree with the decision but the median is part of the agreement. Presumably, as found by previous research, reduction of the perceived political nature of the Supreme Court will likely increase the relative specific support in favor of the decision when the respondent and decision are at odds (Gibson and Caldeira 2009, Gibson et al 2014, Baird 2001,).

The above theoretical discussion can be summarized into three empirically testable hypotheses.

H1 : Individuals are more likely to be in favor of decisions that host a moderate median justice even when the decision is opposite of their ideological alignment, compared to decisions that lack a moderate median justice.

H2 : Specific legitimacy of the court will decrease when there is no median contributing to the decision that is not aligned with the respondents' ideological beliefs, compared to cases with a moderate median contributing to the decision.

H3: Long Term diffuse support in the Supreme Court as an institution will remain constant, regardless of the decisions it produces.

Alternatively, the null hypothesis for H1 will also be examined, insofar as public opinion is not more likely to be in favor of specific court decisions if it aligns with their political ideology. The null hypothesis for H2 will be that absence of a median justice on the decision will have no effect on the respondents' level of support for the support contingent on the decision. Experimental Design

This study is based on a nationally representative sample of respondents online utilizing the Amazon Mechanical Turk platform. The survey questionnaire was active on March 26th 2020 and the subject sample size of 718 responses was met within the day though the survey was to be active for thirty days. Incomplete and duplicate submissions have been dropped from the coding process to provide unique responses for the data. The Mechanical Turk respondents were offered the choice to participate in the study regarding the U.S. Supreme Court and their engagement resulted in a $0.50 compensation to be automatically paid within three days of completion. The average time of completion for the survey was 7.6 minutes.

Mechanical Turk is increasingly being used by researchers in the social sciences. Studies have found that samples that come from MTurk are "at least as representative of the U.S. population as traditional subject pools, with gender, race, age, and education all matching the population more closely than college undergraduate samples and internet samples in general (Paolacci, Chandler, and Ipeirotis 2010), and the quality of the data gathered through the platform are as reliable as those collected through other experimental methods (Buhrmester, Kwang, and Gosling 2011). As a result, we find that this provides an adequate body of responses to confidently provide inferences regarding the proposed hypotheses from the data provided.

The initial pre-test questionnaire included demographic questions, questions related to political ideology and engagement, and questions aimed at assessing overall knowledge about the U.S. Supreme Court. Subjects were then randomly assigned to one out of four experimental conditions. For each condition, subjects were asked to read a brief vignette that discusses a recent Supreme Court decision and the voting patterns of that decision. Experimental conditions vary, including an ideologically moderate justice in the Court or no moderate justice. The experimental Court decisions were also identified as liberal or conservative, resulting in a 2x2 design (liberal/median, liberal/no median, conservative/ median, conservative/no median). After reading the vignette, all subjects were asked to respond to a post-survey questionnaire. These included questions aimed at measuring the subject's attitudes toward the Supreme Court decision, and their attitudes toward the U.S. Supreme Court as an institution. Following this, the post-test survey was administered asking respondents about their levels of support for the decisions they received, to find if specific support changed based on the existence or non-existence of the moderate justice. The survey questionnaire can be found in Appendix 1.

The initial pre-test questionnaire included demographic questions, questions related to political ideology and engagement, and questions aimed at assessing overall knowledge about the U.S. Supreme Court. Subjects were then randomly assigned to one out of four experimental conditions. For each condition, subjects were asked to read a brief vignette that discusses a recent Supreme Court decision and the voting patterns of that decision. Experimental conditions vary, including an ideologically moderate justice in the Court or no moderate justice. The experimental Court decisions were also identified as liberal or conservative, resulting in a 2x2 design (liberal/median, liberal/no median, conservative/ median, conservative/no median). After reading the vignette, all subjects were asked to respond to a post-survey questionnaire. These included questions aimed at measuring the subject's attitudes toward the Supreme Court decision, and their attitudes toward the U.S. Supreme Court as an institution. Following this, the post-test survey was administered asking respondents about their levels of support for the decisions they received, to find if specific support changed based on the existence or non-existence of the moderate justice. The survey questionnaire can be found in Appendix 1.

Variable Operationalization

Specific support is identified as the independent variable in this study. This variable was operationalized through the responses provided in the post-treatment questionnaire detailing the support for the decision and willingness to accept the legal impacts of the decision. Diffuse support serves as the dependent variable in this study. This variable was operationalized through the main independent variable and the conditional variable. The interactions between these variables and the variables individually are assessed. This interaction is necessary to analyze the data through an OLS linear regression model.

An interaction variable labelled Median Congruence is the interaction of the median variable and the congruence dummy variable. Based on the randomizers in the experiment, the existence of the median is coded as a 0, the existence of the median is coded as a 1. From the same information, a variable was created based on the decision direction, 1 for liberal and 0 for conservative. For the knowledge questions, separate variables were created for each question, these were counted as 1 if correct and 0 if it was not correct. From the ten knowledge questions, these variables remained separate and then the overall knowledge variable was created combining the 10 variables into one score. Higher values indicated a higher knowledge variable score. The ideology was coded as 1 for liberal and 7 for very conservative, the sample is skewed liberal though this is controlled for in the dataset. Agreement with the decision was coded into a variable, with the ideology and decision direction combined, Ideological Congruence variables ranged from -1, if

respondents received a decision opposite to their ideological identification and 1 if it was the same as their ideology. If the respondent did not identify as liberal or conservative, this was coded as a 0. A dummy variable of congruence was created, 1 indicated the decision was the same as the respondents' ideological alignment and 0 if it did not. The Acquiescence Variable was based on specific support questions, the last question was inverted for higher scores to be more supportive of the court and these questions were added together and averaged to receive an overall score. The other four questions measuring diffuse support remained the same to indicate higher scores meaning stronger support based on the responses to the questions.

Questions regarding general knowledge about the Supreme Court are coded as a single variable that measures the full knowledge of the respondent. The model also includes any demographic factors that may influence the level of knowledge respondents had of the Supreme Court. The existence of the median in the court decision and respondents' opinion on diffuse support, or overall legitimacy of the Supreme Court, were coded based on the treatment provided to the individual. The respondents' recorded ideological beliefs as liberal or conservative and the ideology of the treatment received was made into a new variable. The treatment variables are coded into two different variables to account for the ideological leaning of the decision and the existence of a median, based on the 2x2 model of the vignettes. The coding booklet providing the analysis of the data set acquired can be found in Appendix 2.

An interaction variable labelled Median Congruence, to identify the level of interaction between the Median variable and Congruence Dummy variable. Based on the randomizers in the experiment, the lack of the median is coded as a 0, the existence of the median is coded as a 1. From the same information, a variable was created based on the decision direction, 1 for liberal and 0 for conservative. For the knowledge questions, separate variables were created for each question, these were counted as 1 if correct and 0 if it was not correct. From the ten knowledge questions, these variables remained separate and then the overall knowledge variable was created combining the 10 variables into one score. Higher values indicated a higher knowledge variable score. The ideology was coded as 1 for liberal and 7 for very conservative, the sample is skewed liberal though this is controlled for in the dataset. Agreement with the decision was coded into a variable, with the ideology and decision direction combined, this Ideological Congruence variable ranged from -1, if they got a decision opposite to their ideology and 1 if it was the same as their ideology. If the respondent did not identify as liberal or conservative, this was coded as a 0. A dummy variable of congruence was created, 1 indicated the decision was the same as the respondents' ideological alignment and 0 if it did not. The Acquiescence variable was based on specific support questions, the last question was inverted for higher scores to be more supportive of the court and these questions were added together and averaged to receive an overall score. The other four questions measuring diffuse support remained the same to indicate higher scores meaning stronger support based on the responses to the questions.

Results

The demographics portions of the questionnaires began with gender identification. From the responses provided, 405 individuals identified as male as the majority provided

in the data set. In accordance to age categorization, respondents typically fell between the ages of 30-49 with those in the 18-19 category following. Fewer respondents were identified above the age of 50. Education levels were also factored in with a majority of respondents holding a Bachelor's Degree or some college experience without a degree. Ideological alignment recorded found a majority of respondents to be "Somewhat Liberal", 160 of the recorded responses, "Very Liberal", with 132 responses, and "Neither Liberal nor Conservative" with 124 recorded responses. Of the respondents, the overwhelming majority, 598, voted in the 2016 election with 338 voting Democratic in comparison to 242 voting Republican, 82 voting for Other, and 56 not responding.

Using the previously identified single variable for respondent knowledge of the Supreme Court, respondent answers were coded into a single variable of overall Knowledge. The mean of these responses, indicated in table 5, is 6.68 out of 10 full points. As previous scholarship indicates, knowledge of the court may remain low unless highly contention issues or assignments to the court are brought to the forefront of the media and, as a result, to the constituents (Gibson and Caldeira 2009). Regardless of the recognized knowledge of the makeup of the court, the interaction this has with specific and diffuse support may be influenced by alternative assumptions of impartiality or specific agreement or disagreement with presented cases (Gibson et al 1998, Baird 2001, Gibson et al 2003, Gibson et al 1992, Gibson et al 1995).

In compiling the results from the coded responses from respondents, responses that identified as neither liberal nor conservative were dropped from the data set reducing the number of observations to 594. When respondents identified as neither liberal nor conservative in their ideology, identifying the treatment case holdings being congruent with the ideological beliefs of the respondent would skew the data set. As a result, the mean duration for completion was 470 seconds or 7.8 minutes for the observational responses. The responses were analyzed through an Ordinary Least Squares Regression model, which is the regression traditionally used for the analysis of experimental data.

In Table 1, we present 3 models, each model representing one of our dependent variables, namely Agreement with the court decision, Acquiescence with the court decision, and diffuse support for the court.

Table 1: Effect of existence of a moderate median and of ideological congruence on Agreement with court decision, Acquiescence, and Diffuse Support

VARIABLES	(1) Agreement	(2) Acquiescence	(3) Diffuse Support
Median x Congruence	-0.01	0.33**	0.43*
	(0.34)	(0.15)	(0.24)
Congruence	0.95***	0.17*	-0.25
	(0.25)	(0.1)	(0.17)
Median	0.2	-0.11	-0.07
	(0.23)	(0.1)	(0.17)
Knowledge	-0.06*	0.08***	0.27***
	(0.04)	(0.02)	(0.03)
Ideology	0.03	0.05***	0.06**
	(0.04)	(0.02)	(0.03)
Constant	4.32***	2.28***	1.98***
	(0.32)	(0.15)	(0.24)
Observations	594	594	594
R-squared	0.06	0.09	0.16

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In measuring the Agreement of respondents to the treatment decision received, the interaction variable, including the existence of the median, is not statistically significant, and neither is the dummy Median variable. The findings indicate that it does not matter to respondents if the median takes part in the decision but rather that the decision is ideologically aligned with the respondent. Alternatively, the Congruence Dummy is statistically significant at the .01 level and is moving in the expected positive direction. This further indicates that what matters most to respondents is for them to receive a decision they personally agree with than the existence of the median. The other statistically significant variable is Knowledge, higher knowledge levels appear to be in less agreement with the decisions overall.

The Acquiescence Variable is identified as the Specific Support independent variable. Within this collection of the data, Median Congruence is statistically significant. If respondents are to receive a decision they ideologically agree with that holds a median in the decision, the level of Acquiescence is higher. For one unit of change with the Median Congruence, there is a .3 change in Acquiescence. The Congruence Dummy variable is also statistically significant and is moving in the expected positive direction, indicating that even when decisions are in ideological agreement with the respondent but do not hold a median justice there are higher levels of Acquiescence. However, compared to the Median Congruence variable, this is a weaker relationship. Congruence makes them acquiesce but in addition with the median, they acquiesce almost double the amount. The existence of the Median on its own appears to play no role as it is not statistically significant in this relationship. Knowledge is also found to be statistically significant, indicating that the higher level of knowledge is correlated to higher levels of acquiescence though the value plays a smaller role in achieving Acquiescence than others. Ideology is also identified as statistically significant. Interestingly, the more liberal a respondent self-identities as, the more likely they are to accept the decision overall.

For the Diffuse Support variable, the Interaction variable is significant. For those who agreed with the decision ideologically and had a median justice in the holding, there was more diffuse support recorded for the court. Knowledge also appears to be statistically significant. Higher levels of knowledge are seen to be in a positive relationship with long term institutional support. Liberal alignment, similarly to the specific support variable, was found to be statistically significant in contributing to the levels of recorded diffuse support recorded through the Ideology variable. The diffuse support appears to be conditional, on its own the Median and Congruence variables are not statistically significant but in tandem they are. The existence of the median appears to give more legitimacy to the decision but this effect is limited to cases when the Court's audience ideologically agrees with the decision made by the Court.

Discussion and Conclusion

As previously discussed, the polarity of ideological and political divides has led to questioning the level of impartiality and, as a result, legitimacy for the Supreme Court as an institution in the eyes of its constituents. This study intends to join the literature base concerning the mitigating factors influencing both specific and diffuse support. This is done in the context of assessing whether the inclusion of a Median Justice in the holding

influences this in the eyes of the Court's constituents.

Addressing the hypotheses presented in the study, the analysis of the results begins with analyzing the variations in specific support dependent on the existence of a Median Justice. The findings indicate that it matters more for decisions to be aligned with the respondent's ideology than for the Median to be a part of it. However, when the Median is included in the decision and the decision falls in the same ideological direction of the respondent, the level of specific support is higher. The existence of the Median on its own appears to play no role in the specific support, providing evidence that is contrary to the second hypothesis regarding the lack of ideological alignment with a decision may be mitigated through the existence of the Median Justice. Finally, the hypothesis concerning diffuse support was assumed to remain relatively high as articulated through previous scholarship. However, this could be a result from minor fluctuations in diffuse support that coexist with the more dynamic specific support. Findings indicated that those who were more knowledgeable had higher levels of perceived legitimacy for the Supreme Court, as has been found previously. Additionally, respondents identifying as more politically liberal were found to have higher levels of institutional support. From the data, no clear relationship between the existence of the Median or its interaction with congruence of ideology play a role in influencing this.

Although the findings of this study present a relationship between the existence of acquiescence to decisions hosting a Median Justice and is in line with the respondents ideological alignment, further research would need to be conducted to better understand the extent of this relationship. The study's experiment was run as a pilot limited to compensation for 718 respondents, and to be able to measure the ideological alignment of these responses, this was further limited to 594 responses. Additionally, due to the confinement of the pilot study's compensation and the utilization of Amazon's Mechanical Turk platform, future studies utilizing a higher volume of individuals and a different method of data collection could be utilized. This could provide a more accurate and representative sample to better translate the study outcomes to the U.S. population at large in answering this question regarding Supreme Court legitimacy. Moreover, the limitation of the treatment cases provided to the respondents fell under one of the topic areas found to be interesting enough to respondents though not as politically charged as a holding regarding a more highly politicized topic such as immigration. Future studies could utilize a wider array of cases and provide more than one case to a respondent with varying ideological leanings on top of the existence of the Median Justice.

To conclude, this study provides support to the hypotheses presented regarding the influence of the existence of a Median Justice on public perception of Supreme Court legitimacy. While this specific portion of the discussion regarding Supreme Court legitimacy is less covered in the literature review, this will provide a foundation to the discussion of what the influence on specific and diffuse support looks like in a highly politicized United States.

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Appendix 1

Questionnaire provided to respondents:
PRE-TEST QUESTIONNAIRE
First, we would like to learn a bit about you. Please respond to the following questions.
1) What gender do you identify with?
a) Female, b) Male, c) Other
2) In which age group of the following do you belong?
a) 18-29, b) 30-49, c) 50-69, d) 70 and over
3) What is the highest level of school you have completed or the highest degree you have received?
a) 8 grades or less, b) 9-12 grades, c) 12 grades, d) Some college but no degree, e) Associate degree in college, f) Bachelor's degree, g) Master's degree, h) Professional school, i) Doctorate degree, j) Other [Specify]
4) Which state do you reside in? _____
5) When it comes to politics, would you describe yourself as liberal, conservative, or neither liberal nor conservative?
a) Very liberal, b) Somewhat liberal, c) Closer to liberals, d) Neither liberal nor conservative, e) Closer to conservatives, f) Somewhat conservative, g) Very conservative
6) Did you vote in the 2016 presidential elections?
a) Yes, b) No
7) If yes, which party did you vote for?
a) Republican, b) Democrat, c) Other
8) If no, which party would you have voted for if you had voted?
a) Republican, b) Democrat, c) Other
9) Out of the three following issues, which one do you consider to be the most important to you?
a) Whether the government should be allowed to monitor citizens' searches on the internet, without a warrant from a judge, including the internet searches of U.S. citizens, to watch for suspicious activities
b) Whether the state governments should be allowed to require consumers to pay sales tax on items they buy on the internet and other purchases across state lines
c) Whether children of foreigners and undocumented immigrants who just happened to be born in the U.S. should be automatically given American citizenship.
10) For each of the issues, please indicate what your position on the issue is
Strongly disagree_____Neither_____Strongly Agree
Now we would like to ask you some questions about the United States Supreme Court.
11) Who is the Chief Justice of the U.S. Supreme Court?
a) Roberts, b) Ginsburg, c) Thomas, d) Kavanaugh, e) Do not know
12) Who was the first female justice of the U.S. Supreme Court?
a) Ginsburg, b) Kagan, c) O'Connor, d) Sotomayor, e) Do not know
13) Is there an African-American justice currently on the Supreme Court?
a) Yes, b) No, c) Do not know
14) Can the U.S. Supreme Court declare acts of Congress unconstitutional?
a) Yes, b) No, c) Do not know
15) Some judges in the United States are elected; others are appointed to the bench. Do you happen to know if the justices of the U.S. Supreme Court are elected or appointed to the bench? a) Elected, b) Appointed, c) Do not know

16) Some judges in the United States serve for a set number of years; others serve a life term. Do you happen to know whether the justices of the U.S. Supreme Court serve for a set number of years or whether they serve a life term?
a) Life term, b) Set number of years, c) Do not know

17) Do you happen to know who has the last say when there is a conflict over the meaning of the Constitution - the United States Supreme Court, the United States Congress, or the president?
a) The U.S. Supreme Court, b) The U.S. Congress, c) The president, d) Do not know

18) Do you happen to know if the U.S. Supreme Court has made decisions on abortion?
a) Yes, b) No, c) Do not know

19) Do you happen to know if the U.S. Supreme Court has made decisions on rights of African-Americans?
a) Yes, b) No, c) Do not know

20) Do you happen to know if the U.S. Supreme Court has made decisions on the maximum income tax rate?
a) Yes, b) no, c) Do not know

EXPERIMENTAL CONDITIONS

Please read through the following article excerpts regarding Supreme Court decisions and answer the following questions.

Last week the U.S. Supreme Court announced its decision on whether the government should be allowed to monitor citizens' searches on the internet, without a warrant from a judge, including the internet searches of U.S. citizens, to watch for suspicious activities. The Court decided that such monitoring is constitutional because it does not violate citizens' right to privacy. The 5-4 decision was along party lines, with the five conservative justices of the court joining in the majority, and the four liberal justices dissenting.

POST-TREATMENT QUESTIONNAIRE

Now we would like to get an idea about your attitudes toward this Court decision. Please respond to the following questions.

1) Do you agree with the decision made by the U.S. Supreme Court?
a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Disagree strongly

2) Because of this decision would you support or oppose efforts to overturn this decision with a constitutional amendment?
a) Strongly support, b) Support, c) Somewhat support, d) Somewhat oppose, e) Oppose, f) Strongly oppose

3) Because of this decision would you support or oppose efforts to get more judges on the Supreme Court who agree with you on the issue of the decision?
a) Strongly support, b) Support, c) Somewhat support, d) Somewhat oppose, e) Oppose, f) Strongly oppose

4) Because of this decision, would you support or oppose efforts to remove judges who voted the wrong way on this case?
a) Strongly support, b) Support, c) Somewhat support, d) Somewhat oppose, e) Oppose, f) Strongly oppose

5) Do you accept the decision made by the court? That is, do you think that the decision ought to be accepted and considered to be the final word on the matter or that there ought to be an effort to challenge the decision and get it changed?
a) Strongly believe the decision ought to be accepted and considered the final word on the matter,
b) Somewhat believe the decision ought to be accepted and considered the final word on the matter,
c) Somewhat believe there ought to be an effort to challenge the decision and get it changed, d) Strongly believe there ought to be an effort to challenge the decision and get it changed.

Now we would like to ask you some more general questions about the U.S. Supreme Court:

6) If the United States Supreme Court started making a lot of decisions that most people disagree with, it might be better to do away with the Supreme Court altogether. a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Disagree strongly

7) Judges on the United States Supreme Court who consistently make decisions at odds with what a majority of the people want should be removed from their position as judge.
a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Disagree strongly

8) The United States Supreme Court ought to be made less independent so that it listens a lot more to what the people want.
a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Disagree strongly

9) It is inevitable that the United States Supreme Court gets mixed up in politics; therefore, we ought to have stronger means of controlling the actions of the United States Supreme Court. a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Disagree strongly

**From the identified importance of three topic areas, government monitoring of internet searching, paying internet sales tax, and American Citizenship, an overwhelming 350 responses indicated the most importance or interest was on cases regarding government monitoring of internet searches. Indications of the position held by the respondents on the issue of government monitoring of internet search histories, 295 responses were in the "Strongly Disagree" category, followed by 145 "Somewhat Disagree" responses and 105 "Somewhat Agree" responses. Assessing the identification of ideological alignment and the responses from the federal monitoring of internet search histories, from the "Strongly Disagree" category, those who identified as "Somewhat" or "Very Liberal" were in the majority of the responses with those "Neither Liberal nor Conservative", following.

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Substance Use Expectancies and Their Relation to Substance Use in College Students

Abstract

Substance use expectancies is a social learning perspective rooted in outcome expectancy theory that states, a person will use or refrain from using a substance depending on the outcome they wish to achieve. The aim of my research is to explore the possible substance use expectancies that students from the college population hold on alcohol and prescription stimulants (PS). Using a survey format, participants recruited from the psychology department answered questions regarding their expectancies on the two chosen substances. The two measures that were used were previously developed and psychoanalyzed; these measures were the Alcohol Expectancy Questionnaire (AEQ-3; George et al., 1995) and the Stimulant Medication Outcome Expectancy Questionnaire (SMOEQ; Labbe & Maisto, 2010). Multiple linear regression was the statistical test that was ran to determine if there was any relationship between the two variables: expectancies and use. Due to unanticipated circumstances, there is no data to report and this study is still in progress. I expect to see similar findings that were shown in previous research which states, if positive expectancies are to be found within the individual, then they should have higher level of use, compared to those who hole negative expectancies. If this study is able to add to the understanding of substance use expectancies, more viable treatment can be explored to combat the increase of substance use behaviors.

Substance use expectancies are categorized as the implicit associations that individuals hold regarding substance use. This concept is rooted in outcome expectancy theory, which proposes that individuals engage in certain behaviors based on a desired outcome they wish to obtain, the outcome can either be positive or negative. It is noteworthy that previous research looking into substance use expectancies has suggested that positive expectancies typically promote substance use, whereas negative expectancies, will promote avoidant behaviors towards substance use. (Galen, Henderson, Coovert, 2001; Kristjansson, Agrawal, Lynskey, Chassin, 2012). Current statistical findings gathered by the National Survey of Drug Use and Health conducted by the National Institute on Drug Abuse found that in the year 2018, respondents in the age group 18-25 years old were questioned on their use of illicit substances at three different times: lifetime, past year, and past month. The findings of this survey were 55.6%, 38.70%, and 23.90% respectively (Schulenberg, Johnston, O'Malley, Bachman, Miech, 2019). When engaging with a smaller sample size, like the campus of California Polytechnic State University-Pomona, CPP, the data showed that out of 1,330 students 4.4% of the male population, 3.2% of the female population, and 3.7% of the total population had used prescription stimulants in the last 3 months. For hallucinogens, the percentages were 5.7%, 4.3%, 5.0% respectively (American College Health Association, 2020). In comparison to previous years, the amount of people partaking in substance use is increasing, thus creating a need for some type of intervention, especially in the college population (Schulenberg, 2018). When using the theory of substance use expectancy as a lens to observe the phenomena of substance use behaviors within the college population, it has the potential to reveal new insight into this complex epidemic, as well as allow for new innovative treatment options to be explored and implemented.

This study will explore the expectancies that college individuals hold on various substances. The first substance expectancy that will be assessed will be for alcohol, which can be seen a more socially acceptable substance. The second substance expectancy that will be assessed is for prescription stimulants (PS); although PS are not an illicit substance when given under Dr.'s supervision, I will primarily be focusing on the illicit use of this substance, taking PS without a Dr.'s prescription. The prediction for this study will be that (a) alcohol expectancies are associated with levels of alcohol use (Galen et al., 2001), (b) Prescription stimulants (PS) expectancies are associated with levels of PS use (Teter et al., 2005), and (c) expectancies regarding alcohol use are associated with expectancies regarding PS use. These predictions are based on previous research that has shown some correlation between the expectancy one holds and the amount they use. Also, the last prediction that is made is based on the framework that was laid out in the Interactional-Transformational model, which proposes that expectancies change and transform overtime and when they interact with one another (Leventhal & Schmitz, 2006). For example, if an individual has a positive expectancy for a substance, they may feel more inclined to use another substance because they already hold positive expectancy for another substance; If someone feels comfortable drinking alcohol because they believe it will help them relax, that same person will be more comfortable smoking marijuana because they believe it may also relax them. The alcohol expectancy is now influencing the marijuana expectancy.

Outcome expectancy theory laid the foundation for future researchers to apply it to different substances in order to examine the motivating factors that lead to certain behaviors, in this instance substance use. In the early years of this research, most of the time was dedicated to alcohol expectancy theory (Aaron, Brown, Coe, 2001; Galen, Henderson, Coovert, 2001; Hayaki, Henderson, and Stein; Got & Hezel-Riggin, 2018). Many researches explored what were the initial beliefs that these people held and why did they lead them to partake in alcohol use. Some of the most basic expectancies that were identified were undifferentiated expectancies in which individuals reported that drinking alcohol "seemed like magic to them. As well as, "specific expectancies" for example some individuals may state that "alcohol makes them more sociable. (Galen et al., 2000). Because of this early research on alcohol expectancy, researchers have been able to build on the literature of expectancy by branching out into other substances. Exploring the specific substances individuals hold for other substances has proven to be equally important; however, there has been some gaps in the research, in which where these expectancies were looked at individually rather than holistically.

Alcohol

It has been reported in multiple studies that these expectancies that Individual's hold play a vital role in the etiology and progression of alcohol use to abuse (Aaron et al., 2001; Brown, 1993; Leventhal & Schmitz, 2006). This is said to arise from the fact that individuals hold a number of positive expectancies regarding using alcohol and initiate use to obtain those desired results; when individuals begin to construct these expectancies, they become more prevalent in the decision-making process, which influences substance use behaviors. Also, drinking to deal with life's adversities and negative affect have shown to be a significant predictor of problem drinking when compared to other drinking motives, such as physical – social pleasure and sexual enhancement (Galen et al., 2001).

When individuals partake in substance use behaviors in terms of coping, they initially have an expectation that the negative feelings will go away after drinking alcohol, this is their positive expectation they hold for alcohol. On the other hand, when individuals showed to hold more negative expectancies regarding alcohol drinking behaviors, there were signs of cessation and avoidance of use; these negative expectancies consisted of beliefs that drinking and excessive drinking can lead to an array of health problems as well as lead to dangerous behaviors (Galen et al., 2001; Gott & Hetzel-Riggin, 2018; Leventhal & Schmitz., 2016). Because researchers were able to develop psychometrically sound tools like the Alcohol Expectancy Questionnaire, AEQ, to accurately measure expectancies individuals hold when it came to drinking alcohol, they were able to further expand it to explore expectancies for other different substances (Kristjanson et al., 2012).

Marijuana & Stimulants

Diving into the more psychoactive substances, researchers began to apply expectancy theory to specific substances, other than alcohol, to diversify the literature and explore the various expectancies people held when it came to other substances. One of those substances to be explored was marijuana, this may have well been because of the similarity it has to alcohol on the person's body and mind; as well as the fact that both tend to be seen as less socially deviant as the other harder illicit substances (Gott & Hetzel-Riggin, 2018; Kristjanson et al., 2012). Measures were applied to a diverse set of samples through multiples studies ranging from adolescents and young adults, some of those measures consisted of reworked items from the Alcohol effect Questionnaire, AEQ, and the Marijuana Effect Expectancy Questionnaire, MEEQ, (Aaron et al 2001; Kristjanson et al., 2012). The findings that were reported from one of the studied showed similarities to alcohol, particularly that negative expectancies were found typically in non-users; the implication that this has in terms of treatment, is that negative expectancies can be seen as a protective factor when it comes to marijuana use (Kristjanson, et al., 2012).

Looking further into the more socially deviant substances, research on expectancies among nonabstinent community cocaine users had important findings that furthered the literature of substance use. In this study, it was reported that individuals who held positive expectancies, particularly enhancement of social and physical pleasure, showed a significant sign of cocaine use; However it was also shown that those who expected greater cognitive and physical impairment decreased frequency of use(Hayaki et al., 2008). Both findings of this study are consistent with the findings of past research looking into marijuana and alcohol. Because there has been similar finding with expectancies across various substances, it shows that there is some overlap between expectancies, meaning that they perhaps interact with one another and influence one another.

Methods

Subjects

A sample size of x participants was collected to be a part of this study. The target sample size that was aimed for was 43 participants; this expected sample size was determined using G*power, a power analysis software that computed the sample size with the input parameters of effect size set at 0.15, the error of probability at .05, and power set .80. The population that I pooled from was Cal Poly Pomona students, specifically student from the psychology department. Using convenient sampling, subjects were recruited from courses in the psychology department through the Sona system and were given 0.25 course credit for each 15 minutes of their time volunteered. Because of CPP being such a diverse campus in terms of race and ethnicity, it is expected that the sample will be representative of the population of the geographic location the university is at, which is Pomona. All participants had to click to consented to be a part of the study, if they did click, they indicated that they were at least 18 years old and understood that they would receive credit regardless of completing the study or not. This section is not fully complete due to no participants being recruited for the study. I am presenting this section in the way it was supposed to be written if participant were collected and provided data. This study is still ongoing. If participants were collected, the study sample would be reported. As well as the mean age of the participants and the Mean and standard dev of the participants' gender.

Materials

In order to identify the expectancies that students hold and their role in the decision-making process of using substances, a quantitative study was conducted. The framework that guided my research was based on outcome expectancy theory. In using this framework for my study, it allowed me to home in on the expectancies that are held by students and see how they influence one another. The Sona system was used as a recruitment tool to bring in the needed sample size. The survey was built on the Qualtrics system and was used to collect the data from the participants. Demographic questions that asked about age, race/ethnicity, sexual orientation, major, class standing, and combined household income were used in the survey. The substance use history for various drugs was assessed using a survey question that asked to report usage in the past 12 months; the scale was never, less than monthly, monthly, weekly, and daily or almost daily. To explore the usage for the two chosen substances, alcohol and PS, the survey question asked to report their usage in the last 12 months and lifetime, the same scales mentioned before was used as well. The two measures that were utilized in this study were the Drug Effect Questionnaire (AEQ-3) which was formed by George et al., 1995 and the Stimulant Medication Outcome Expectancy Questionnaire (SMOEQ) by Labbe & Maisto, 2010. The AEQ-3 was used to assess the expectancy that students held by asking them to rate how much they agree with the statement that was presented to them. The scale for the AEQ-3 was a 6-point Likert. The SMOEQ was used to assess the expectancy that students held on PS by asking to report how much they agree or disagree with the statement. This scale was on a &-point Likert scale

Procedure

Once participants signed up to be a part of the study, they were provided a link to complete the survey on Qualtrics. They were told that this study was going to look at some of their thoughts on various substances. All participants were given an informed consent form to read, the participant had to click to consent before being able to begin the study. Once students clicked to consent, the survey began, and they were asked to answer basic demographic questions. After this they were asked to report on their lifetime usage.

The participants then moved on to the two measures that were being used and reported how much they agreed with a certain statement using Likert-Scales. Upon completing the expectancy questionnaires, students were provided with a debriefing statement that stated the actual purpose of this study, which was to assess their substance use expectancies and see if they are influencing their substance use behavior. They were thanked for their participation and provided with contact information of the researcher to ensure they can ask questions if any would arise. Once the data was collected, SPSS was used to run statistical analysis on the data. A multiple linear regression test was used to determine if there is a relationship between the two variables that were being studied.

Results

As of this moment, there are no results to report. I however expect to see similar findings that were found in previous research. For example, it was shown that there is a positive relationship between expectancy and usage. In many studies, when an individual held a positive expectancy they used a substance; With that being said, the results that we should see should show that (a) possession of positive alcohol expectancies will result in the individual having a higher alcohol usage compared to those who hold negative expectancies, (b) possession of positive PS expectancies will result in the individual having higher PS usage compared to those who hold negative expectancies, and (c) If an individual has an positive alcohol expectancy, then they should also have a positive expectancy for PS.

Discussions

Exploring the beliefs that individuals hold when it comes to substance use has serious implication in the realm of public health and safety, particularly in the college population. If these expectancies are understood, then the ones that cause substance use behaviors can be challenged so that they may halt substance use and promote avoidant behaviors. If the findings of this study show that the expectancies differ across different substances, but that they indeed interact with one another, then interventions can be utilized to bring the number of people using down. Also, in taking a more holistic approach rather than individually looking at substances, the complex issue of substance use and SUD can be further understood, thus adding to the rapidly growing body of expectancy research.

Limitations

Progress has been moving a bit slowly for this project, but nonetheless, there has been significant strides in the IRB application as well as the survey production. My mentor and I have been meeting weekly and going through the IRB, section by section, ensuring that all the proper information is there so that the IRB can accept the proposal on the first time. The meetings tend to go on for two hours during my mentor's office hours, and a lot is learned during this time. Also, there has been a change in the research team. Originally, I was the main investigator for this project, with Dr. Sturges guiding me, however, I recently took on a new Co-PI. Upon teaming with this new research partner, I had to update him with the innerworkings of the project, as well as the concepts that need to be known. Although the IRB application is not approved yet, we are confident that the IRB will be completed and

approved before the end of this semester. With that being said, data collection will continue on until the end of fall 2021. I will continue my work outside of being a student and will still be working along side my mentor and Co-PI to complete this report.

The nature of schooling during the pandemic was a big factor in how the project progressed during the school year. My mentor definitely had more work to do since schooling was online, and I as well was met with various challenges. Zoom was not the most effective way to build rapport with a mentor and work on a senior project together, the distance made it difficult to ask question face to face and work through talks together. We were able to overcome this by sticking to a set schedule for when we were to meet, although it was challenging, my mentor and I pushed on and made strides to complete this IRB. It was not our intentions to start the data collection process this late in the semester, but with the opportunity for me to continue this research outside of my bachelors, the research team and I figured that this will not be a big issue, and the study can still be completed.

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Mai
Richard

Inactivation of Foodborne Spoilage and Pathogenic Microorganisms in Commercial Juices by Synergistic Applications of Lauric Arginate and Mild Thermal Processing

Abstract

Minimal and efficient food processing is important in the food industry to achieve food safety, efficiency, and to preserve as much of the original nutrients of the food as possible. This study is designed to explore processing of foods by combining treatments to inactivate Escherichia coli O157:H7, Listeria innocua and Alicyclobacillus acidoterrestris in apple juice and coconut water. The antimicrobial efficacy of individual treatment including lauric arginate (LAE), mild thermal processing (55°C), and combined treatment (LAE + mild thermal processing) were analyzed in commercial juices against the above-mentioned foodborne microorganisms. Current partial results indicated that combination of LAE and mild thermal processing successfully inactivated 4.5 and 7.5 log of E. coli in coconut water and apple juice, respectively. Further researches are designed to test the efficacy of combined treatment (LAE + mild thermal processing) against L. innocua and A. acidoterrestris. In conclusion, combination of a food preservative (LAE) and mild thermal processing (55°C) has demonstrated synergistic inactivation against foodborne spoilage and pathogenic microorganisms in commercial juices. This technology may prove to be a potential novel food processing strategy to be applied in food industry.
Keywords: Lauric arginate, mild heat, synergy, food processing, food safety

Introduction

Conventional hurdle techniques involving sequential application of physical and chemical food processing serve to inactivate spoilage and pathogenic bacteria in solid and liquid foods. More research involving the simultaneous combination of chemical (polyphenolics and peptide) and physical (mild thermal, light and ultrasound) treatment have emerged (Jung & Matthews, 2015). This strategy involves the synergistic antimicrobial effect while both physical and chemical processes are being carried out at the same time. Another example of synergy in food processing is the combination of ultrasound and mild heat treatment for microbial reduction for the extension of the shelf-life of fresh-cut bell peppers (Luo & Oh, 2015), where the sum of microbial inactivation of both treatments together is significantly greater than if each treatment was done alone. Studies have reported that the combination of lauric arginate (LAE) (a food preservative) and mild thermal processing at 55 °C have demonstrated significant synergistic antimicrobial effect against both E. coli O157:H7 and L. innocua within four-minute treatments (Yang, Rai, Huu & Nitin, 2019). Mechanistic studies have also shown that this processing exacerbates bacterial membrane damage which leads to nucleic acid leakages.

Alicyclobacillus acidoterrestris is a spore-forming aerobic Gram-positive thermophilic and acidophilic bacterium that can be found in soil and fruit surfaces (Groenewald, Gouws & Witthuhn, 2009). The optimum growth temperature and pH of Alicyclobacillus spp. Is between 40 and 60 °C and pH 3.5 – 4.5, respectively. The thermophilic nature of Alicyclobacillus makes fruit juices from tropical regions more susceptible for harboring the growth of this bacteria. It was estimated that 11.4% of apple juice concentrates in Argentina

is contaminated with Aliciclobacillus (Hu, Huang, Barringer & Yousef, 2020). The low pH growth range of this microorganism also indicates the potential to spoil various commercial fruit juices such as apple, orange, grape and pineapple juices. What is worse is Alicyclobacillus spp. spores are more likely to cause spoilage in fruit juices because these spores cannot be inactivated under standard juice pasteurization (90-95 °C, 15-20 s) without deterioration of the quality of the juices. Heat-resistant spores after pasteurization can germinate in fruit juices with high acidity when stored and distributed during the spring and summer seasons (Huang, Yuan, Gu, Gekas & Yue, 2015).

This study initiated to apply the pre-existing process of synergistically deactivating effects of the combination of LAE and mild thermal processing in apple juice and coconut water. Both juices were chosen as the liquid food matrices because they vary in pH, where apple juice is acidic and coconut water is more neutral (Chauhan, Archana, Singh, Raju & Bawa, 2014). E. coli, L. innocua and A. acidoterrestris were selected as the matrices' inoculated spoilage/pathogenic indicators. The juices were subsequently treated with the combination of LAE and mild thermal processing. Survivor population of the microbes will be monitored using plate count methodologies. Juice quality parameters including pH value and turbidity will also be monitored by pH meter and plate reader. Synergistic combinations of food-grade compounds and low levels of physical processing show potential to enhance antimicrobial activity and may is useful in providing safe and efficient food to the public without compromising the integrity of flavor and nutrients.

Materials and Methods

Reagents for this project includes Market Pantry Apple Juice (purchased from a retail store and kept at 4 °C), sodium chloride (to make 0.85% NaCl sterile saline solution), Criterion Tryptic Soy Broth, VWR bacteriological agar, and rifampicin. Trypticase soy agar (TSA) with rifampicin was created as the selective agar media in this project. Deionized (DI) water was preheated in a PYREX® bottle on a hot plate. The amount of dehydrated TSB used was 3 grams for every 100 ml of DI water and 1.5 grams of agar for every 100 ml of DI water. Both the TSB and agar were combined into the PYRREX® bottle, brought to a boil while periodically swirling, then autoclaved for 15 minutes. A 50mg/ml concentrated solution rifampicin antibiotic solution was created using rifampicin and DI water. Then 1 μl of rifampicin stock was added to the TSA broth for every 1 ml of TSA broth used. With aseptic technique, the broth was poured into the sterile agar plates until the bottom of the plates were completely covered. The plates were then left to cool and solidify.

Rifampin-resistant E. coli cultures were grown in TSB at 37 °C overnight. The culture was then centrifuged for 1 minute at maximum speed and washed twice in sterile saline solution. The overnight culture was then 10-fold serial diluted and enumerated on TSA plates with rifampicin. For LAE individual treatment (marked as LAE-alone from this point and forward), LAE was inoculated in apple juice (with E. coli around 107 CFU/ml) at 15, 30 and 50 ppm. The mixture was then incubated at room temperature for 4 min, followed with enumeration. For mild heat treatment (marked as heat-alone from this point and forward), apple juice with E. coli at 107 CFU/ml was treated in a pre-heated (55 °C) glass scintillation vials for 4 min, before the mixture was enumerated. The combined treatment (LAE + mild

thermal) sample is prepared as LAE-only solution, followed with mild heat treatment at 55 °C for 4 min, before the mixture was enumerated. Each processing technique was repeated for a total of three times.

Results and Discussion

Preliminary work from UC Davis done by Dr. Xu Yang shows that combined treatment of LAE plus heat presented synergistic inactivation of target bacteria in apple juice and coconut water. (see Figure 1 in Appendix A). LAE alone presented less than 1 Log CFU/ml inactivation of microbes. Heat alone did not inactivate any more than LAE alone. When combining LAE with heat treatments, this significantly reduced the microbial count around 4-log in coconut water and more than 6-log in apple juice. The difference in the amount of inactivation between the two juices are likely due to the differences in pH levels (Chauhan et al., 2014).

At Cal Poly Pomona, three replicates of each type of processing were performed and the enumerated survival populations of each category were averaged (see tables in Appendix B). As seen in Figure 2 in Appendix A, differences are between techniques are visually discernable. LAE alone and heat alone treatments shows little inactivation of E. coli. The combination of heat plus LAE at 15 ppm shows the first significant reduction in bacterial inactivation compared to the unprocessed sample, showing average bacterial counts of around 3-log versus about 7-log respectively. When increasing LAE concentrations to 30 ppm, this further reduces the bacterial count to an average of around 1-log, and at 50 ppm with heat shows no further significant decrease in bacterial count (1-log). These findings validate the study conducted at UC Davis in that the combination of LAE and mild heat treatment shows synergistic microbial inactivation effects of apple juice.

Conclusion

Synergistic inactivation of E. coli O157:H7 has been observed between the GRAS antimicrobial compound LAE and mild thermal processing in apple juice which caused membrane damage of the bacteria due to oxidative stress. The effective concentrations of LAE tested were 15, 30 and 50 ppm. Similar results were achieved from both institutions between UC Davis and Cal Poly Pomona. The synergistic application of food processing techniques can be utilized in the food industry to allow for more avenues of providing food to the public in a safer and more efficient way.

Acknowledgements

Future works

More replicates are going to be generated at Cal Poly Pomona in a similar setting utilizing A. acidoterrestris and L. innocua. Coconut water will also be tested, in addition to apple juice. Food quality testing involving pH and turbidity will be tested once LAE is inoculated in apple juice and coconut water.

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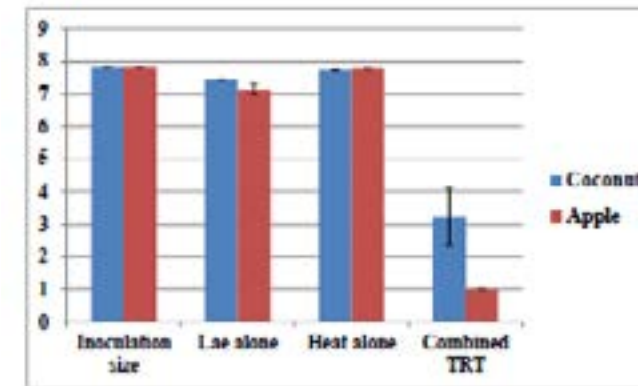
Appendix A

Figure A1: Synergistic inactivation of E. coli O157 H7 between LAE (50 ppm) and mild heat (55 °C) for 4 min for coconut water and apple juice.
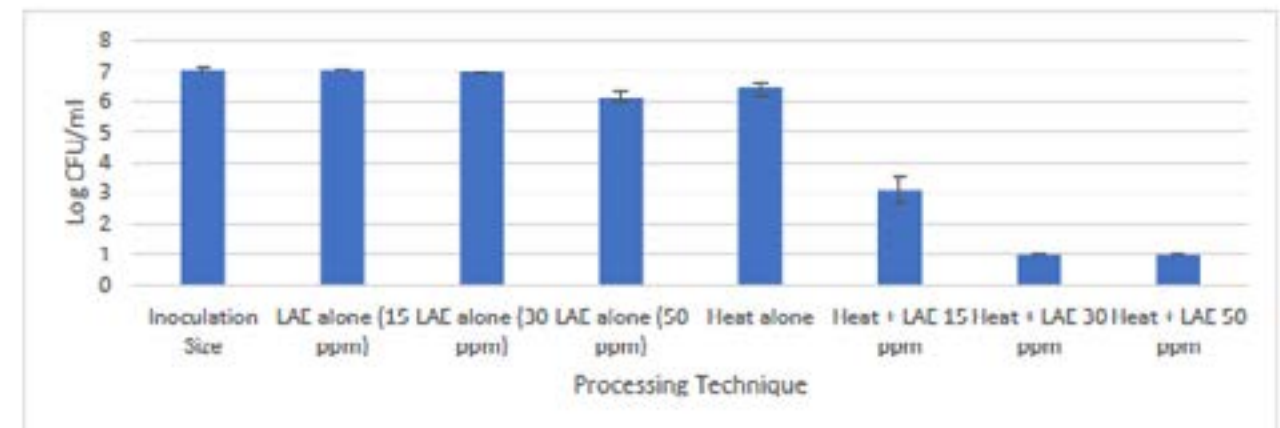

Figure A2: Average synergistic inactivation of *E. coli* O157:H7 across three replicates of LAE (15, 30 and 50 ppm), mild heat (55 °C) and LAE plus mild heat over 4 min for apple juice.

Appendix B

Table B1: Bacterial enumeration of Replicate 1.

Data	Counts	Dilution	Population	Log Population
Overnight Culture	115	1.00E-06	1.15E+09	9.06
Inoculation Size	115	1.00E-04	1.15E+07	7.06
LAE alone (15 ppm)	110	1.00E-04	1.10E+07	7.04
LAE alone (30 ppm)	81	1.00E-04	8.10E+06	6.91
LAE alone (50 ppm)	98	1.00E-03	9.80E+05	5.99
Heat alone	22	1.00E-04	2.20E+06	6.34
Heat + LAE 15 ppm	46	1.00E+00	4.60E+02	2.66
Heat + LAE 30 ppm	1	1.00E+00	1.00E+01	1.00
Heat + LAE 50 ppm	1	1.00E+00	1.00E+01	1.00

Table B2: Bacterial enumeration of Replicate 2.

Data	Counts	Dilution	Population	Log Population
Overnight Culture	129	1.00E-06	1.29E+09	9.11
Inoculation Size	129	1.00E-04	1.29E+07	7.11
LAE alone (15 ppm)	120	1.00E-04	1.20E+07	7.08
LAE alone (30 ppm)	97	1.00E-04	9.70E+06	6.99
LAE alone (50 ppm)	22	1.00E-04	2.20E+06	6.34
Heat alone	19	1.00E-04	1.90E+06	6.28
Heat + LAE 15 ppm	138	1.00E+00	1.38E+03	3.14
Heat + LAE 30 ppm	1	1.00E+00	1.00E+01	1.00
Heat + LAE 50 ppm	1	1.00E+00	1.00E+01	1.00

Table B3: Bacterial enumeration of Replicate 3.

Data	Counts	Dilution	Population	Log Population
Overnight Culture	105	1.00E-06	1.05E+09	9.02
Inoculation Size	105	1.00E-04	1.05E+07	7.02
LAE alone (15 ppm)	122	1.00E-04	1.22E+07	7.09
LAE alone (30 ppm)	97	1.00E-04	9.70E+06	6.99
LAE alone (50 ppm)	120	1.00E-03	1.20E+06	6.08
Heat alone	49	1.00E-04	4.90E+06	6.69
Heat + LAE 15 ppm	378	1.00E+00	3.78E+03	3.58
Heat + LAE 30 ppm	1	1.00E+00	1.00E+01	1.00
Heat + LAE 50 ppm	1	1.00E+00	1.00E+01	1.00

Table B4: Average bacterial enumeration across three replicates

Data	Replicate 1	Replicate 2	Replicate 3	Average Log Population	Std. Dev.
Inoculation Size	7.06	7.11	7.02	7.06	0.04
LAE alone (15 ppm)	7.04	7.08	7.09	7.07	0.02
LAE alone (30 ppm)	6.91	6.99	6.99	6.96	0.05
LAE alone (50 ppm)	5.99	6.34	6.08	6.14	0.18
Heat alone	6.34	6.28	6.69	6.44	0.22
Heat + LAE 15 ppm	2.66	3.14	3.58	3.13	0.46
Heat + LAE 30 ppm	1.00	1.00	1.00	1.00	0.00
Heat + LAE 50 ppm	1.00	1.00	1.00	1.00	0.00

McKinney
William

Performance and Dynamic Stability of a Variable-Pitch Drone Under Turbulence

Abstract

Fixed-pitch propeller drones are widely used for academic research projects as they are easy to implement and mechanically simple. However, they are limited by the rotational inertia of their propellers, cannot efficiently achieve reverse thrust, become control-saturated during aggressive flight regimes, and compromise on maximum thrust and efficiency during flight. Variable pitch mechanisms on quadrotors have been used to address these problems under ideal, low turbulence intensity conditions. The performance of a fixed-pitch quadrotor has been studied under turbulent conditions in a wind tunnel, and a model for how quadrotors are susceptible to turbulence was created. This study aims to build upon these works by comparing the performance of fixed-pitch and variable pitch mechanisms attached to a one degree-of-freedom arm under a range of turbulence intensities. Turbulence will be introduced using a custom-built wind tunnel. PID control software will be run on an Arduino Uno, and testing will be conducted with multiple PID tuning strategies. We hypothesize that a variable-pitch-equipped test rig will generally take less time to reach a nominal position and hold that position more closely than its fixed-pitch counterpart under highly turbulent conditions. This study will provide a starting point for further research on using variable pitch mechanisms to reject turbulence. Continued development of this technology will be of significant interest to the drone industry, as their technology is pushed to be used in more turbulent environments (e.g. search and rescue, package delivery and military purposes).

Literature Review

A variable pitch mechanism provides control that is often compared to shifting gears in a car. Low gears (low pitch angles) are used to accelerate from low speeds, while high gears (high pitch angles) are used for operating at high speeds. Both methods maximize the efficiency of an engine by staying on its power band. Changing pitch also provides an added dimension of control over thrust besides regulating the RPM of the propeller. These benefits were explored in the development of early airplanes and experimental vehicles.
The first recorded variable-pitch propeller quadrotor (the "Flying Octopus") was developed in 1922 by Georges De Bothezat and Ivan Jerome [1]. Although it could not be fully controlled in flight, it proved to be stable and flew over one hundred times [2]. The first automatic variable pitch propeller mechanism patent was awarded in 1929 to Wallace Turnbull (US1828303A). This design allowed the user to adjust the pitch of propeller blades on an airplane using an electric motor. Subsequent development of automatic variable pitch propeller mechanisms was undertaken by Frank Caldwell. From 1918 - 1938, Caldwell's mechanisms complemented advances in drag reduction and increased engine power [3]. Airplanes equipped with these mechanisms could reach higher top speeds without stalling and gave pilots more control over the performance of their planes in WWII. The Convertawings Model A was the first quadrotor concept to achieve forward flight in 1956 [4]. Responsive and agile control was achieved by varying the pitch of each propeller. The HoverBot, developed by Johann Borenstein at the University of Michigan around 1992, was a promising attempt at autonomous variable-pitch flight utilizing custom PID control software [5]. The Flying Octopus, Convertawings Model A and Hoverbot were all cancelled shortly after initial testing due to funding cuts.

Variable pitch mechanisms have been adapted to small quadrotors for academic purposes in recent years. Generally, the same qualities and advantages of these mechanisms on planes and experimental vehicles can be replicated on a smaller scale. Researchers have discovered several benefits of variable pitch quadrotor designs.

A team at MIT's Aerospace Controls Lab (ACL) laid the groundwork for applying these mechanisms to small, agile quadrotors in 2012 [6]. The group noted that while fixed-pitch propeller drones are widely used for academic research and hobby projects, they are not ideal as the flight envelope expands. At small scales, they are limited by the rotational inertia of their motors and propellers, and cannot efficiently achieve reverse thrust. At larger scales, the inertias of propellers become much larger than the motors driving them, and it is much harder to change their RPM. Large quadrotors cannot be stabilized by only regulating the voltage to their motors (thereby changing the propeller's speed) because of these large inertias. Instead, they must have another degree of control over thrust, which can be addressed with variable pitch mechanisms. Additionally, variable pitch mechanisms provide a greater thrust response (increasing maximum rate of thrust change). When combined with reverse-thrust capability, the prototype drone showed a large improvement in position tracking and control saturation during aggressive flight.

This work was further developed by former ACL research assistant Mark Cutler in his master's thesis later that year. Using the same considerations and models, Cutler authored a more detailed analysis on the benefits of variable pitch quadrotors and documented a quaternion-based control algorithm with trajectory generation [7]. Through simulations and experimental results, Cutler further demonstrated the advantages of increased acceleration, decreased control saturation, and reverse thrust. These advantages resulted in improved tracking of the commands given by the control algorithm. Cutler also described the negative effects of vibration on the performance of a drone prototype from different commercial and custom solutions. The best solutions for reducing vibrations on the drone were to use mechanisms designed for RC airplanes on individual motors and stiffen the drone's frame. Cutler noted that the following topics had already been well-addressed by other research papers: quadrotor dynamics, control schemes, trajectory generation and control bandwidth for large quadrotors (referenced in paper).

Shortly after Cutler's thesis, in 2013, the first hobby-grade variable pitch quadcopter became commercially available. The Stingray 500, developed by Curtis Youngblood, demonstrated the aggressive and acrobatic flight capabilities of this concept on FliteTest's YouTube channel [8]. The product and others like it have been discontinued.

More recently, research on variable pitch mechanisms for quadrotors has focused on optimizing the performance of drone designs for practical applications. Through testing and mathematical modeling, the maximum achievable thrust of a propeller was increased by 31% and its efficiency improved by 2.6 - 7.5% (depending on thrust demanded), by introducing a variable pitch mechanism [9]. The design of a hybrid quadrotor-VTOL UAV was shown to benefit from variable pitch propellers by adding control authority, enabling the use of gasoline as a fuel source and providing options for greater efficiency during hover and forward flight [10]. PID controllers are also being modeled and optimized for the stability of custom platforms [11, 12]. The research and testing discussed above was conducted under quiescent or near-quiescent flows.

Turbulent flows are ever-present in real-world scenarios and must be studied to create more robust and accurate models of stability in realistic conditions. A way of introducing this turbulence to UAVs is to design controlled testing environments tuned to specific flight conditions. Examples of such controlled environments include UC Merced's Scientific Data-drone Test Site [13] and Stanford's multi-purpose wind tunnel [14]. Researchers experimenting with variable pitch propellers [9] noted that the following topics have been covered by other research (references included in paper): behavior of fixed-pitch propellers in stationary air and wind tunnels and variable pitch blades tested for helicopters. Research has even been conducted on the stability of a fixed-pitch drone in a wind tunnel under turbulent conditions [15]. In that study, a model was created to analyze the susceptibility of a drone to turbulence, which can be applied to similar future work.

It does not appear, however, that an analysis of a variable pitch quadrotor's performance under a range of turbulence intensities, or a comparison of fixed propeller performance to variable pitch propeller performance under the same conditions, has been done. It can be inferred from previous research that variable pitch propellers will generally not provide better position tracking than fixed pitch propellers under low intensity turbulence. However, it would be reasonable to expect that under highly turbulent flows (where the acceleration demands are high to maintain stability), fixed pitch propeller systems would become saturated, where variable pitch propeller systems would be better able to achieve acceleration demands. This would mean that variable pitch propeller drones would take less time to reach a nominal position and hold that position more closely than fixed pitch propeller drones.

This study will attempt to test these hypotheses using commercially available hardware, a PID control algorithm and a custom wind tunnel testing environment for introducing varying turbulence intensity disturbances. The quadrotor will be simplified to a one degree-of-freedom arm resting on a pivot with two motors attached to either end. A practical guide for how to accomplish PID control of this kind of system (for fixed-pitch propellers) has been documented on YouTube by Electronoobs [16]. Adapting his methods to a variable-pitch-equipped variant will provide a reasonable approximation of the performance of a quadrotor stabilized on one axis under turbulence. A video created by Joop Brokking shows a similar test stand in the same configuration to demonstrate how to tune the different PID gains [17]. Other projects have included tuning the PID controller on a full fixed-pitch quadcopter by constraining it to the roll axis [18, 19].

Similar practical builds have been demonstrated on YouTube for 1-DOF helicopters. 1-DOF helicopters consist of arms attached to a pivot on one end and a motor and propeller on the other end. These kinds of projects are typically seen in upper-level engineering courses that involve robotics and control systems [20, 21]. The limitations of these fixed-pitch designs are clearly shown in a video published by Acrome Robotics to advertise their "1-DOF Copter" educational product [22]. In the video, it is clear that when the arm overshoots its target position, it is unable to generate reverse thrust. It must turn off and wait until gravity drops it down to start balancing again, where a variable pitch mechanism could cause even greater decelerations.

Creating limited-DOF helicopters and drones for studying PID control is not new in research literature, either. Using a black-box model, the force produced by a motor and propeller on a pivot was correlated with the pulse width of the signal applied [23]. This correlation was used to develop a mathematical model, PID controller and a sliding-mode controller. The PID controller was found to only take 2 seconds to stabilize and overshot by 5%, whereas the sliding-mode controller took twice as long and overshot by 4 times as much under normal operating conditions. However, the sliding-mode controller performed better than the PID controller under continuous disturbance by resisting oscillation. Similarly, a fuzzy PI controller has been developed for a 1 DOF helicopter, a 3 DOF drone attached to a wooden test rig was modeled and methods for 1 DOF control were presented [24, 25]. These examples provide both practical and theoretical support for creating a 1 DOF drone test fixture. The novelty of this research will be building one of these systems with variable-pitch mechanisms, which is hypothesized to enhance the drone's capabilities under turbulence.

Further development of variable pitch technology promises to expand the capabilities of commercial and industrial drones. Industries requiring large drones and flight in turbulent conditions will see the greatest benefits.

Methods

Hardware Methods

In order to create the testing environment and introduce turbulence to the system, a subsonic open-circuit wind tunnel was the most practical and adjustable solution. It was chosen over closed-circuit wind tunnels because of the lack of space in a home environment and the added complexity closed designs require for redirecting the airflow. Ideally, this system would have been tested in a professional or academic-grade wind tunnel that could finely filter out unintended disturbances and have built-in measuring tools like high-resolution hot wire anemometers. However, this research had to be conducted at the author's home, and was subject to the budget and time constraints of the project.

Common practices in professional wind tunnel testing are to use a fan to draw air over the model (instead of pushing air through it) and a honeycomb-shaped flow straightener to limit unintended disturbances. Upon testing, the fan did not pull the air through the wind tunnel as effectively as it pushed it through the tunnel. The direction was reversed so that the fan pushed through the wind tunnel for the rest of the project. It was decided that this would ultimately cause more turbulence, which would lead to more perturbations for the drone to resist and a greater range of conditions to test. The author believes having a larger range of conditions enriched the data and made the test more representative of real-world conditions.
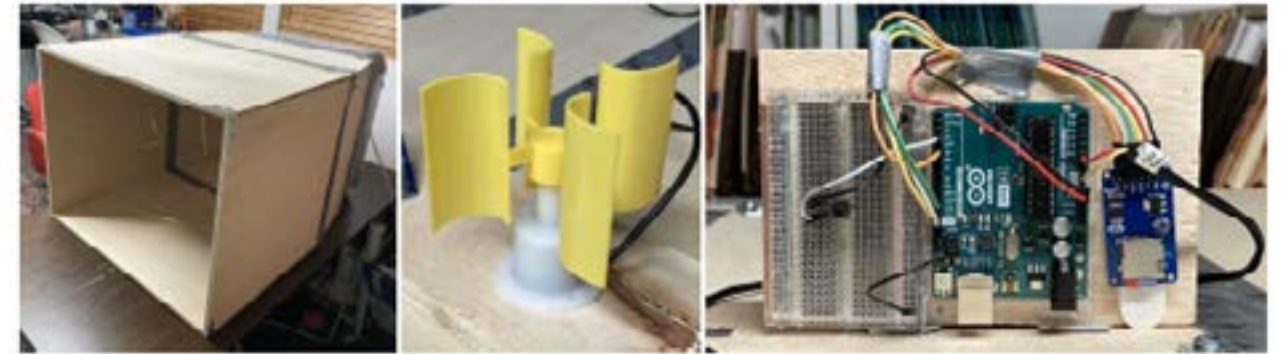
Figure 1: Wind tunnel, anemometer and Arduino wind speed recording device

Component	Component Pins	Arduino Pins
Button	LEFT LEG, RIGHT LEG	GND, PIN 2
Anemometer	RED, YELLOW	A0, GND
Micro SD Card Reader	CS, SCK, MOSI, MISO, VCC, GND	PINS 4, 13, 11, 12, 5V, GND

Table 1: Wind Speed Recorder Component Wiring Guide

Comparative (dimensionless) values were gathered to make the project both reproducible and significant to future research. Both the Reynolds number and turbulence intensity values were calculated for each scenario, which signified the overall quality of the airflow in the test chamber. These values were determined from data collected with a generic 12V/24V output anemometer found on Ebay.com (Fig. 1). This sensor is a proven technology used by the Arduino hobbyist community, as demonstrated by the youtuber Science Fun [27]. This sensor was used over other methods because hot wire anemometry and similar commercially available solutions are either prohibitively expensive, cannot be used to write data to a program like Excel for analysis, or have poor to no documentation on how to use it, as is the case for the Wind Sensor Rev. C from the Modern Device company. Pitot tubes were also considered, but they are not accurate under turbulent conditions.

Using the raw wind speed data, sampled at a frequency of 1 Hz for 10 seconds, a vector plot was made that demonstrates the behavior of the flow. Using the instantaneous wind velocity measurements, the average wind velocity, Reynolds number and turbulence intensity can be calculated by the equations shown below.

$$\overline{U} = \frac{1}{T} \int_{t_0}^{t_0+T} U(t)\, dt$$

Average Velocity Expression

$$U' = U - \overline{U}$$

Flow Velocity Change Expression

$$I = \frac{\sqrt{\overline{(U')^2}}}{\overline{U}} = \left(\left[\frac{1}{T} \int_{t_0}^{t_0+T} (U')^2\, dt\right]^{1/2}\right) \div$$

Turbulence Intensity Expression

$$Re = \frac{\rho \overline{U} l}{\mu}$$

Reynolds Number Expression

$\overline{U}$ = Average flow velocity

t_0 = Initial time of sample

T = Total time taken in data

U = Instantaneous flow velocity measurement

U' = Difference between the instantaneous and average flow velocity

$\overline{U'}$ = Average of difference between instantaneous and average flow velocity

ρ = Density of the fluid

l = Characteristic length (defined as the hydraulic diameter of the rectangular pipe)

μ = Dynamic viscosity of the fluid

Figure 2. Turbulent Signal with Annotations [28]

An example of a turbulent signal taken at a position A (hence UA) in a flow is shown in Figure 2. Annotations have been added to show the physical and intuitive significance of the values in the turbulence intensity expression.

In professional-grade Atmospheric Boundary Layer (ABL) wind tunnels, real-world turbulence is simulated by using specific features. These features include spires, barriers, carpets and distributed roughness elements which impact model buildings. Instead of feature-driven turbulence, this study will use an easier-to-implement technique that is derived from observing the Reynolds number expression. Changing either the flow speed in the chamber or characteristic length of the surfaces under consideration can change the Reynolds number. Generally, Reynolds numbers under 2000 are laminar, between 2000 and 4000 are transitional, and over 4000 are turbulent. It follows that a change in the classification of turbulence under these limits would also change the turbulence intensity in the chamber. Instead of making different diameter flow straighteners and different testing chambers, the average airflow speed was changed to cause shifts in the Reynolds number.

The project used the, "Air King 9723 20-Inch 3-Speed Box Fan" to pull air through the test chamber. This fan is a great choice because of its 2140 CFM rating: a much greater capacity than comparable box fans on the market. This model also came with a metal frame, which gave rigidity to the fan and system. The box fan will be integrated into the wind tunnel design through a custom adapter (Fig. 3). The box fan speed came with 3 speeds, which was assumed to be adequate for testing a range of turbulent conditions.

Figure 3: Wind Tunnel Design

The wind tunnel was constructed from generic sanded ¼ inch thick plywood, which allowed the system to be built under budget. This wood is easy to modify, cheap and easy to replace, and can be fastened with everyday wood screws found at home. Wood glue and duct tape were used to seal all edges and eliminate potential leaks.

Generally, wind tunnels used for studying laminar flows over objects achieve a turbulence intensity of 1-10%. Many premiere wind tunnels have pushed their turbulence intensity values well under 1%, which is excellent for studying laminar flow over objects.

Usually, turbulence intensities at or over 10% are unacceptable, except for instances where simulating real, turbulent scenarios is important. The experimental wind tunnel at Stanford, mentioned earlier, can create a range of turbulence intensities from 0.03% to 45% [14]. The turbulence experiment conducted by Solberg tested a range of turbulence intensities from 0.75% to 13.15% [15]. Both of these examples used disturbance grids to modulate the turbulence and only allow for intentional turbulence to be introduced to the system.

Assuming the temperature at the time of the experiment was 56 degrees Fahrenheit, the density of air was $1.233\ kg/m^3$ and the dynamic viscosity of the air was $1.700 * 10^{-5} Pa * s$. The rating of the box fan tops out at 2140 CFM, which is equal to the cross-sectional area of the test chamber multiplied by the average velocity of the air in the chamber. The test chamber is 25 inches wide and 20 inches tall.

$$2140\ \frac{ft^3}{min} = A_1 V_1 = (\tfrac{25}{12}\ ft)(\tfrac{20}{12}\ ft)V_1 = (3.472\ ft^2)V_1$$

$$V_1 = 616.32\ \frac{ft}{min} = 3.131\frac{m}{s}$$

The characteristic length of the testing chamber is defined as the hydraulic diameter of the rectangular pipe, which is defined as 4 times the cross-sectional area of the testing chamber divided by the wetted-perimeter.

$$l = \frac{4A}{P} = \frac{4(25\ in)(20\ in)}{(2(25\ in) + 2(20\ in))} = 22.222\ in\ = 0.564\ m$$

The Reynolds number, then, is calculated using the density, average velocity, characteristic length and dynamic viscosity values determined above.

$$Re = \frac{\rho \overline{U} l}{\mu} = \frac{(1.225\ kg/m^3)(3.131\ m/s)(0.564\ m)}{1.788*10^{-5}\ Pa*s} = 120,985$$

Therefore, the theoretical maximum Reynolds number the system can produce is around 120,000. This is not necessarily representative of the real system, because rectangular pipes introduce turbulence from their geometry: air gets trapped and lags in the corners. This has the ability to introduce more turbulence and increase the effective Reynolds number. Additionally, the presence of an object in the tunnel changes the flow velocity, while drawing air through thechamber can cause turbulence at the intake. Other forms of disturbance may also be present.

A more specific and useful metric is measuring the turbulence intensity, because it gives additional information about the quality of the flow from comparing the peaks of velocity to the average velocity in the chamber. Both values were calculated and plotted to give a complete picture of the flow quality in the test chamber.
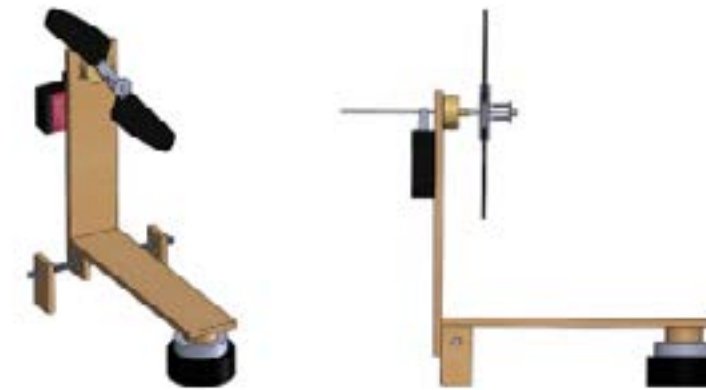
Figure 4: Thrust Testing Device

To address the lack of specifications for the variable pitch mechanism, a different method for determining the thrust output of the propellers was used. This can be done theoretically with the Blade Element Momentum Theory: a system of nonlinear equations are produced to predict the thrust based on angle of attack and airflow velocities along the blade as demonstrated in the variable pitch VTOL UAV study [10]. However, this kind of modeling is time-intensive and prone to error; an alternative method of direct measurement was used instead. A black-box method, as described earlier in the fuzzy PI controller research [24], is appropriate to measure the thrust from varying the RPM and pitch angle. By keeping the RPM constant and varying pitch or keeping pitch constant while varying RPM, a plot was created to show the effect of these changes on thrust. These plots were fitted to a curve, which informed the design of a PID controller. The values were gathered from a wooden thrust measurement apparatus with equidistant arms from a pivot (Fig. 4). The moment about this point must be zero, so the normal force registered by the scale was the thrust output. The pitch was measured using a protractor and attaching a straw to the ends of the propellers.

Figure 5: Overall Assembly

As discussed in Cutler's master's thesis [7], the design for a quadrotor with the least amount of vibrations and best agile performance is one with four independent motors and hobby-grade pitch mechanisms intended for RC planes. Designs that rely on pulleys to transmit power from one motor and mechanisms meant for RC helicopter tail rotors introduce significant vibrations to the system. While the Stingray 500 achieved acrobatic flight using a pulley system and modified helicopter tail rotor pitch mechanisms, it is not clear if this limited its potential.

This study will attempt to adapt Cutler's design to a one degree-of-freedom arm (Fig. 5). The electronic variable pitch (EVP) system Cutler used has since been discontinued, so more available technology was sourced. Generally, the market for variable pitch propeller mechanisms has few options to choose from. The most suitable mechanism was the pre-assembled "Metal EVP 4D Variable Pitch System - MEVP 2122" by the brand AEO RC, which is available as of May 2021 on dwhobby.com. This was the most well-built and powerful rc-grade pitch mechanism considered in this study. Another, similar yet less robust option was the "CZ F3P 4D Variable Pitch Propeller" paired with the "Mayatech 2815 series F3P hollow shaft motor" from banggood.com (also available as of May 2021).

Electronoob's introductory video on the PID control of brushless motors was used as a reference [16]. Based on the video, an Arduino Uno, MPU 6050 module, a threaded rod, nuts and bearings were sourced. A 6 inch long, 0.25 inch diameter, 20 threads-per-inch (1/4-20) threaded rod was used to provide a common feature to connect the arm to supports. For low friction and the ability to pivot, 0.25" internal-diameter bearings were press-fitted into wooden support arms. To keep both the arm and bearings in place, 1/4-20 nuts were screwed onto the threaded rod against the inner-race of the bearings and the rotating arm (Fig 6).

Additionally, 30 amp ESCs (rated for 2-4s batteries) were chosen to allow overhead for surges in current draw. 25kg-capacity metal gear servos were used for actuating the pitch mechanisms, as per the manufacturer's recommendation of strong servo motors. The ESC's include battery eliminator circuits (BECs) that step down the voltage coming from the battery to power accessories like servos and a receiver. 5V was provided from one of the ESCs to power the Arduino Uno, servos, motors, the MPU6050 and micro SD card reader modules. Electronoob's suggestions for proper wiring was expanded from common knowledge in the Arduino community to include the two servos and a micro sd card reader (Fig. 7). A 2s high discharge battery pack (80C) was used to avoid a bottleneck on current demand from the battery.
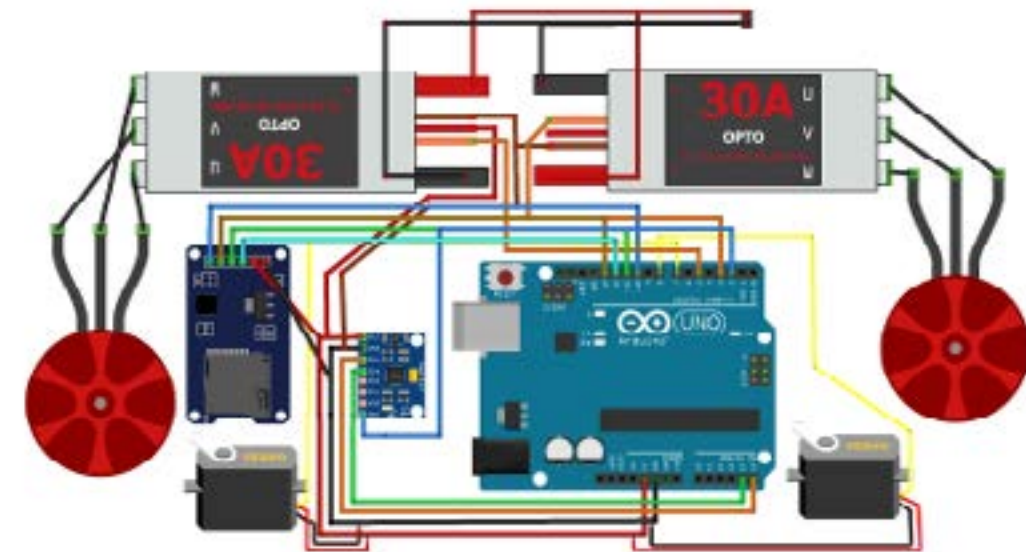
Figure 7: Fritzing Wiring Schematic

Component	Component Pins	Arduino Pins
Left Motor	VCC, GND, SIGNAL	5V, GND, PIN 5
Right Motor	VCC, GND, SIGNAL	5V, GND, PIN 3
Left Servo	VCC, GND, SIGNAL	5V, GND, PIN 7
Right Servo	VCC, GND, SIGNAL	GND, PIN 7
MPU 6050	VCC, GND, SCL, SDA	5V, GND, SCL, SDA
Micro SD Card Reader	CS, SCK, MOSI, MISO, VCC, GND	PINS 10, 13, 11, 12, 5V, GND

Table 2: Test Rig Component Wiring Guide

Figure 6: Ball Bearing and Nut Layout

Attaching the control rod of the variable pitch mechanisms to the servos was accomplished by using Du-Bro 605 E-Z Connectors. These connectors allowed for the non-deforming attachment of the control rod to the servo, and made it easier overall to handle translating the motion from the servo to the mechanism (Fig. 8).

Figure 8: Servo Sub-assembly and Du-Bro 605 E-Z Connectors [26]

To compare the performance of a fixed-pitch propeller system to a variable-pitch propeller system, the servos were fixed at a variety of positions to test whether a specific fixed-pitch angle can perform similarly or better to letting the servos be controlled by a PID control loop (at a variety of constant motor speeds). To ensure consistent results, the arm was reset to around 30 degrees from the zero position and the battery was fully charged before each test. The position data were recorded and analyzed to see which solution holds closer to a target position and is able to reach a target position faster. The data were recorded directly to a MicroSD card on the one DOF arm for better cable management and fear of getting the cables caught on the propeller blades.

Software was required to implement the theory of PID control loops in real-life. The optimization of this software resulted in stable flight and disturbance rejection.

Software Methods

The code for this project is available at https://github.com/williammckinney/ Drone-Research-Project as of May 2021. It was written to run on the Arduino Uno Rev. 3 using the Arduino IDE. Compatibility with other Arduino development boards may vary.

In order to collect the wind speed data, the software needed to do several things: tell the arduino to wait until it was time to record data, record the voltage of the anemometer at a consistent frequency, transform the voltage into a wind speed, and record the wind speeds onto an SD card as a .txt file. Pseudocode for collecting the wind speed data is the following:

1) Include the necessary libraries (SPI and SD) for communicating and writing to the micro SD card module

2) Create a wind speed variable to store the wind speed values from the anemometer

3) Begin serial communication to the computer

4) Specify pin 2 as an input to measure the voltage coming from the anemometer

5) Print a message whether or not SD card communication was successful

6) Forever, read pin 2 voltage

    a) Multiply the read voltage by the conversion given by the manufacturer

    b) If a button is pushed, create a new file on the SD card

    c) Record the data on the same file for 10 measurements, and wait 1 second for each

    d) Stop recording and close the file

For testing the thrust as a function of pitch and thrust, a simple program was created that told the Arduino to begin the motor at 0 throttle, which the ESCs accepted. After a delay, the Arduino commanded the motor to speed up to the desired throttle. The angle of the servo for pitch actuation can be set as a constant. The author found that it seemed that the pitch angle was more consistent when it was commanded to start from 0 degrees and then travel to the designated angle with a delay before starting the motors.

For the drone flight software, Electronoob released their software online for others to use. This program was used as a starting point, and further progress was made to suit the needs of the project. The core of the program is sufficiently explained by their YouTube video [16], website (https://electronoobs.com/eng_robotica_tut6.php) and comments in the program itself. An important note: as will be shown in graphs, the PID loop starts at 7 seconds for safety.

Additional functionality was added: the angle and time elapsed values were written to the onboard SD card, and the PID control loop was applied to the servos. PID control of the servos was challenging for a couple of reasons. First, both servos needed to be written to different positions because they faced opposite directions, and the pitch mechanisms changed angles at different rates when given the same servo angle. The relationship between input angle and output was established to address this issue. Secondly, there is a pitch at which the propellers will begin to stall. If this was not accounted for, the propellers extended beyond their performance band, and the overall performance of the system was hindered. Therefore, the PID command should be capped at the angle of maximum thrust, just before stalling.

PID Tuning Strategies and Procedures

Pre-installed Settings

Electronoob's code came pre-installed with PID settings (Kp = 3.55, Ki = 0.005, Kd = 2.05). This was one of the settings considered because both the model in this study and the project in the video have similar characteristics, which would suggest they

would behave similarly. When applied to the speed of the motors, these settings provided stable more consistent when it was commanded to start from 0 degrees and then travel to the designated angle with a delay before starting the motors.

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Manual Tuning Method

One of the most accessible tuning methods is manual tuning when a physical model is available and/or is economical to produce. The general procedure is to set the integral and derivative gains to zero and increase the proportional gain until the system oscillates steadily. Then, divide the proportional gain (Kp) by two and increase the integral gain (Ki) until the system comes to a stop at the target position. Increase the derivative gain (Kd) until the system comes to a stop at a satisfactory speed and time. This does not always lead to the most optimized system, so further adjustments can be made by referring to Table 3. This table can be found on Wikipedia, and is general conceptual knowledge taught in control theory classes at universities.

Parameter	Rise Time	Overshoot	Settling Time	Steady-state-error	Stability
Kp	Decrease	Increase	Small change	Decrease	Degrade
Ki	Decrease	Increase	Increase	Eliminate	Degrade
Kd	Minor Change	Decrease	Decrease	No effect in theory	Improve if Kd small

Table 3: Effects of Increasing a Parameter Independently

Through these methods, manual PID settings for controlling both the speed (Kp = 1, Ki = 0.001, Kd = 0.1) and pitch (Kp = 0.175, Ki = 0.0025, Kd = 0.09) of the propellers were determined. The general method applied well to the speed of the propellers, but for the pitch of the propellers, further adjustment and compromise between speed and stability was required. The PID settings for the speed of the propellers were determined at a 15 degree pitch angle (stalled just over around 15 degrees). The PID settings for the pitch of the propellers were determined at a speed of around 2400 RPM, or 30% throttle (arbitrary pick: the higher the speed the higher the thrust, 30% was safe to experiment with and did not threaten to break the mechanism).

Ziegler-Nichols Method

The Ziegler-Nichols method is more analytical than manual tuning, yet does not require modeling of the system or other such advanced knowledge. Similar to manual tuning, this method starts by increasing Kp until the system constantly oscillates (reaching neutral stability). Then, record the system's angle as a function of time to find the period of oscillation. The resulting values are called the ultimate gain "Ku" and the ultimate period "Tu". These values can be input into a standard reference table, as seen in system controls courses, (Table 4) to achieve gains as an output [29].

Control Type	Kp	Ki	Kd
PID (Classic)	(0.6)Ku	(1.2)Ku/Tu	(0.075)Ku*Tu
Some Overshoot	Ku/3	(2/3)Ku/Tu	(1/9)Ku/Tu
No Overshoot	(0.2)Ku	(2/5)Ku/Tu	(1/15)Ku/Tu

Table 4: Ziegler-Nichols PID Tuning Reference Table

The recordings of the angle vs time graphs (Fig. 9, Fig. 10) revealed the Ku and Tu for the variable speed controller were 2.0 and 1.08 seconds, and they were 5.0 and 1.06 seconds for the variable pitch controller, respectively. These values led to gains that caused overly aggressive and unstable motions in the system, a known issue with this technique. This aggressive instability was solved by manually tuning the PID gains according to Table 3 and multiplying or dividing the gains by constants. This resulted in more stable flight, of which the "no overshoot" control type was the most desirable. The "no overshoot" control type with manual adjustment was used for both the PID control loop applied to the speed of the propellers (Kp = 1.2, Ki = 0.00741, Kd = 0.123) and the pitch of the propellers (Kp = 0.2, Ki = 0.00378, Kd = 0.105).
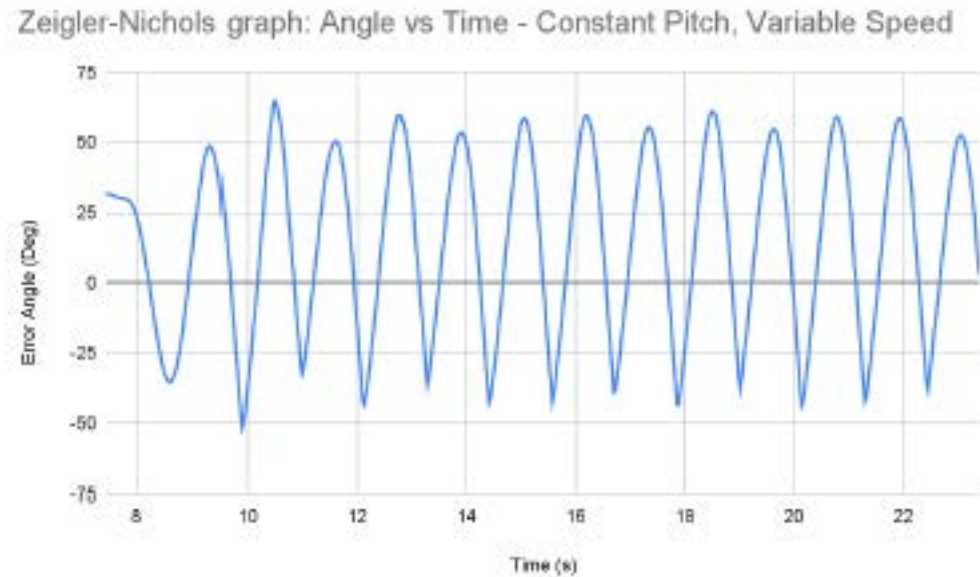
Figure 9: Ziegler-Nichols Graph, Speed PID Control
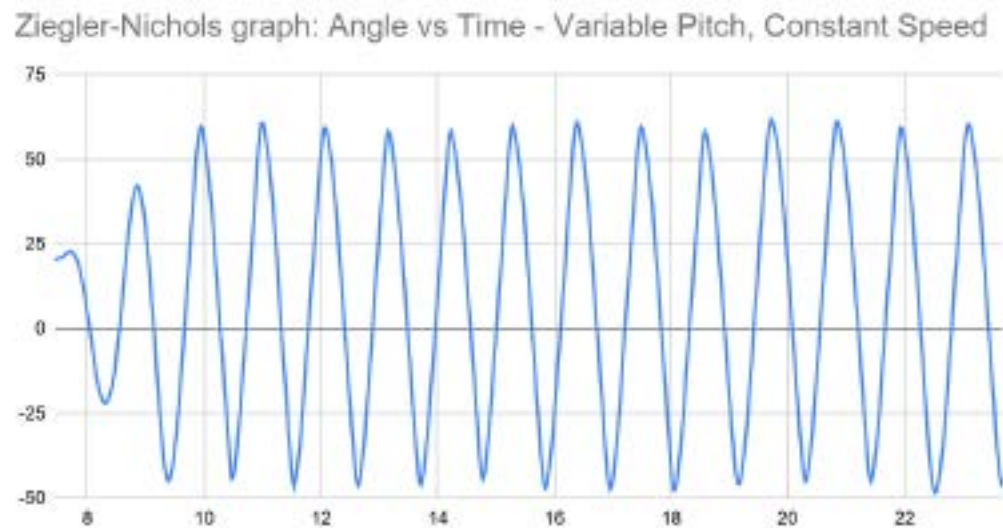
Figure 10: Ziegler-Nichols Graph, Pitch PID Control

Results & Discussion

Figure 11: Anemometer at Various Positions in Wind Tunnel

The first challenge to understanding the flow quality in the wind tunnel was how the air behaved throughout the test chamber. This was done by sampling the velocity at different points in the wind tunnel (Fig.11), averaging the speed at these points and plotting them in 3D space (Fig. 12). The vector plot reveals that the velocity next to the walls are near-zero (green), while the velocities near the center of the tunnel are closer to the maximum velocity achieved in the tunnel (yellow => orange => red), which may suggest fully developed flow.
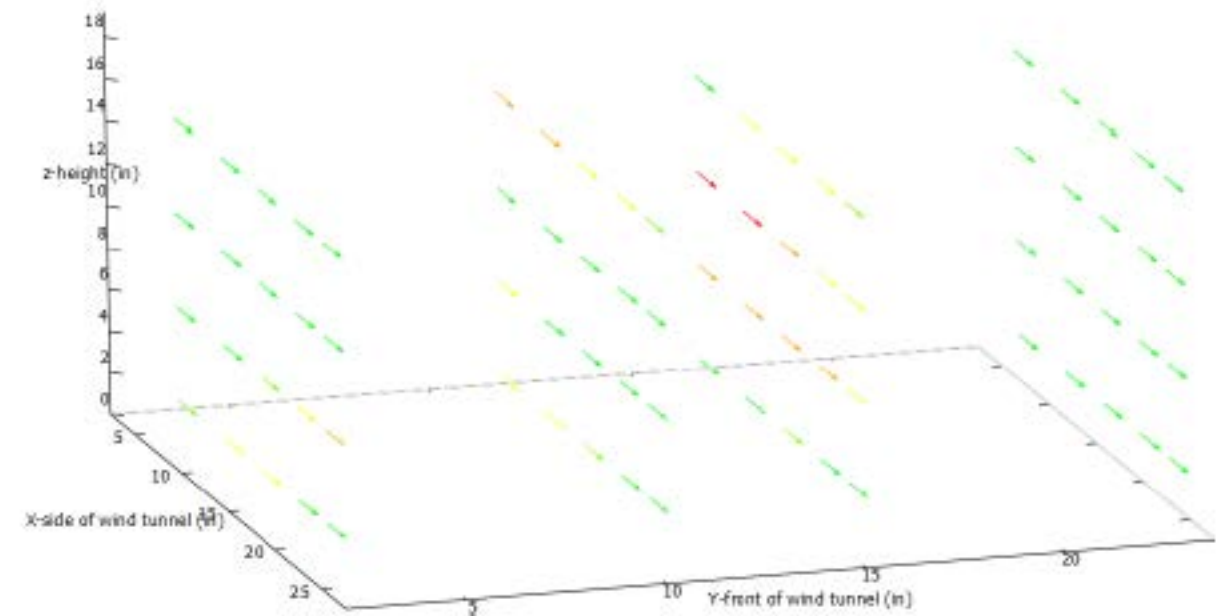
Figure 12: 3D Wind Vector Plot and Behavior in the Wind Tunnel (made with gnuplot)

The highest average velocity, 1.15 m/s, was achieved at the third speed of the wind tunnel. This is one third of the value expected, which resulted in a Reynolds number of 44,000.

$$Re = \frac{\rho \bar{U} l}{\mu} = \frac{(1.225\,kg/m^3)(1.15\,m/s)(0.564\,m)}{1.788*10^{-5}\,Pa*s} = 44,437$$

The highest turbulence intensity at a point in the wind tunnel (x = 10 in, y = 15 in, z = 12.5 inches, as on Fig. 12) was determined by plotting the speed as a function of time (Fig. 13) and using the equations mentioned earlier. From the data points, the average speed at this point is 4.63 m/s. The turbulence intensity at this point is 6.53% (Table 5).
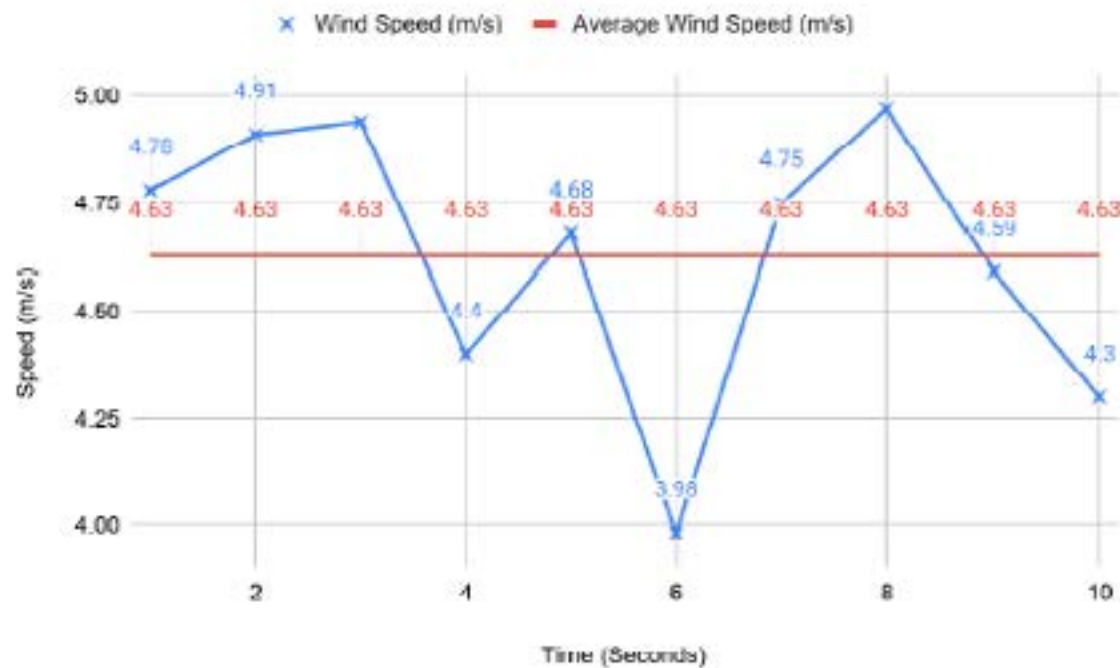
Figure 13: Turbulence Intensity Plot

$$\bar{U} = \frac{1}{T} \int_{t_0}^{t_0+T} U(t)\,dt = 4.63\,m/s$$

U	U	U'	U'^2	$\sqrt{\dfrac{U'^2}{10s}}$	$\sqrt{\dfrac{U'^2}{10s}} \div \bar{U}$	%Turb Intensity
4.78	4.63	0.15	0.0225			
4.91	4.63	0.28	0.0784			
4.94	4.63	0.31	0.0961			
4.4	4.63	-0.23	0.0529			
4.68	4.63	0.05	0.0025			
3.98	4.63	-0.65	0.4225			
4.75	4.63	0.12	0.0144			
4.97	4.63	0.34	0.1156			
4.59	4.63	-0.04	0.0016			
4.3	4.63	-0.33	0.1089	0.303	0.0653	6.53%

Table 5: Turbulence Intensity Calculations

Next, how the motors and variable pitch mechanisms behaved based on an input was studied. The speed of the propellers was measured using a generic digital tachometer found on amazon.com. After applying reflective tape to one of the wings, the tachometer was held level with the propeller and measurements were taken over the course of 10 seconds at a 0 degree pitch angle. The highest RPM recorded in each test was the most accurate to the theoretically expected, which was determined by a percentage of the theoretical maximum RPM. The max theoretical RPM of the motors were 9240 RPM (1100 KV motor times 8.4V from the battery). As expected, the motors were not as efficient as stated, however, the relationship between %throttle and RPM was still linear (Fig. 14)

Theoretical and Actual RPM vs. %Throttle Commanded
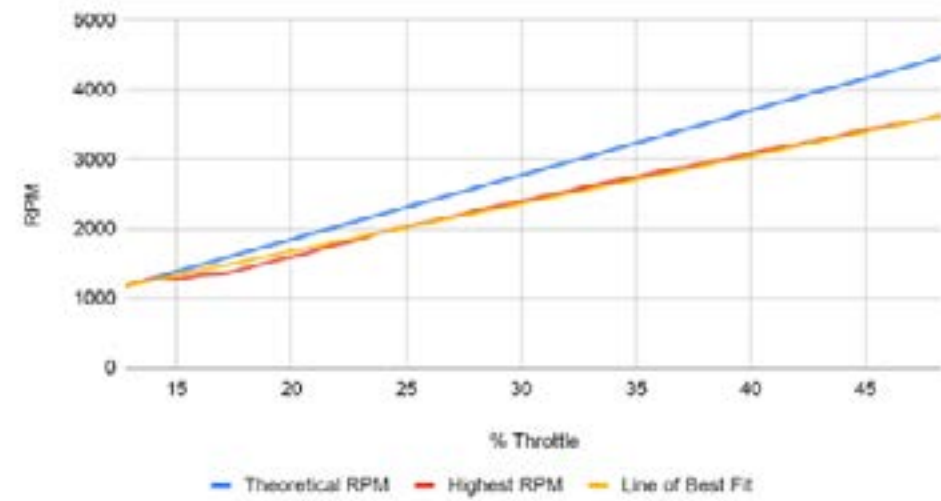
Figure 14: %Throttle Commanded - RPM relationship

The relationship between the servo angle and the pitch angle was more complicated: each servo changed angles differently based on the input command. Two separate relationships (Fig, 15 & Fig. 16) were plotted for each servo to understand how they respond to an input, and the lines of best fit for both were used to achieve the desired pitch angle output for both pitch mechanisms.

The lines of best fit were used as functions to transfer the pitch command of the Arduino software to servo angles. Note that the graphs have opposite slopes of different (yet similar) magnitudes, which reflects their opposite orientations and their physical limitations. These relationships are more or less linear, to a questionable accuracy.

Pitch Angle vs Servo Angle Commanded (Right Servo)
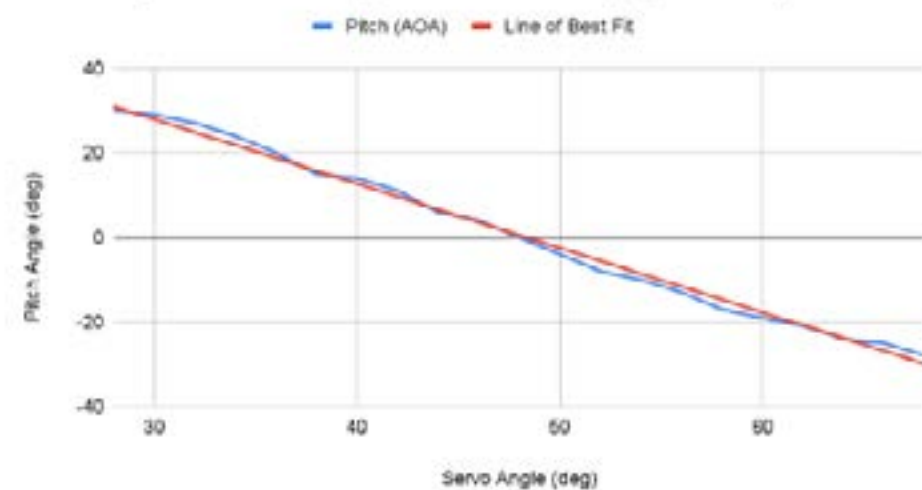
Figure 15: Pitch vs Servo Angle Relationship - Right Servo

Pitch Angle vs. Servo Angle Commanded (Left Servo)

Figure 16: Pitch vs Servo Angle Relationship - Right Servo

The relationship between the thrust, RPM, and pitch of the propellers was determined using a test bench (Fig. 17) to find optimal angles and speeds for the mechanisms.

Figure 17: Thrust Test Bench Mechanism

Thrust Output vs Servo Angle - Constant RPM
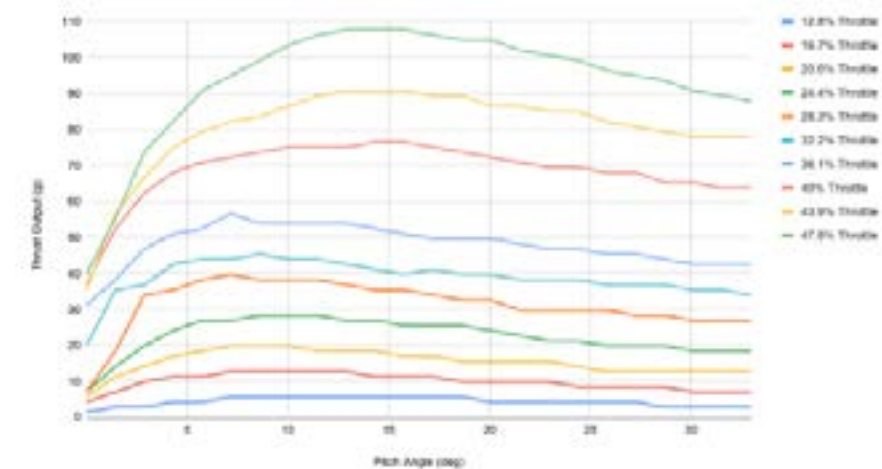
Figure 18: Constant Speed, Variable Pitch Thrust Relationship

The relationship between the thrust and changing the pitch was parabolic (Fig.18), with a definite peak around 15 degrees at higher speeds and around 7 degrees at lower speeds. This is the pitch mechanisms' performance band: beyond this the propellers begin to stall. This is why +15 degrees and 15 degrees were set as limits for the PID pitch controller.

The thrust as a function of throttle was also parabolic, without a clear sign of a limit or stalling point (Fig. 19). The 12.9 degree and 17.2 degree pitch angles performed the best, indicating 15 degrees as the correct assumption for a limit.
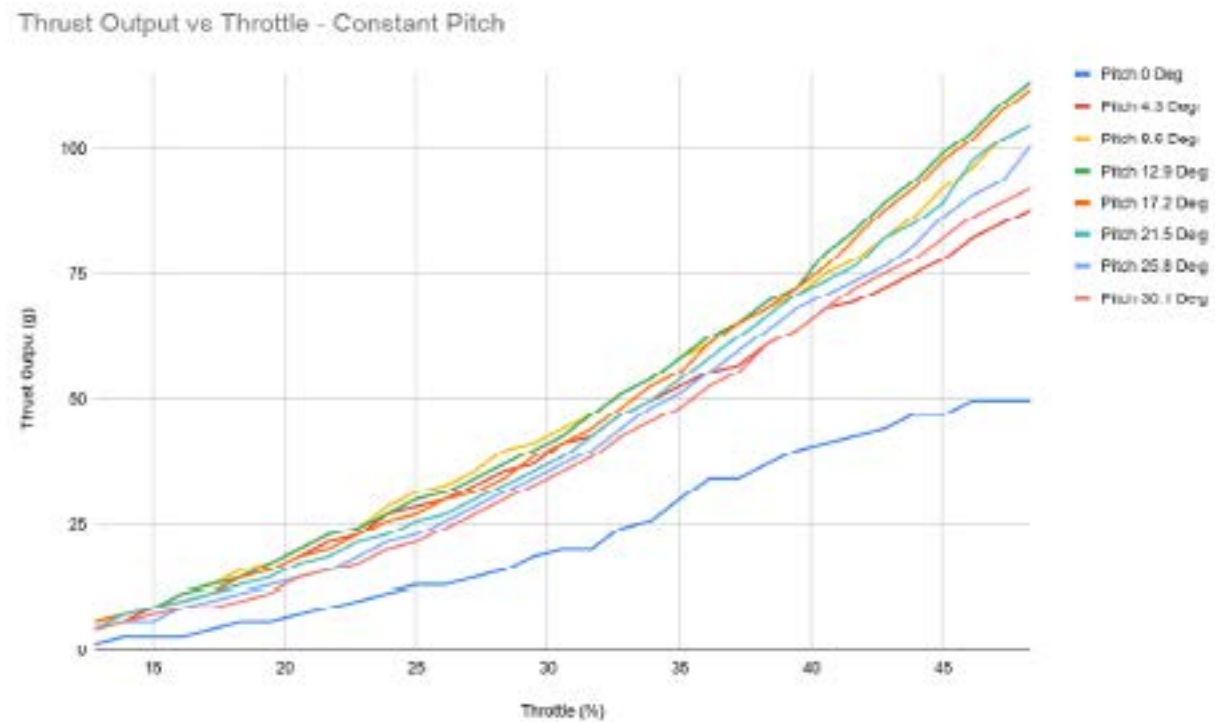
Figure 19: Constant Pitch, Variable Speed Thrust Relationship

Finally, the drone could be flown given this information (Fig. 20) It can be seen flying in this YouTube video: https://www.youtube.com/watch?v=X4C-UEtl-EI.

Figure 20: Drone in Wind Tunnel

Figure 21: Ziegler-Nichols-Tuned PID RPM Control Loop Graph

Manually-Tuned PID Pitch Control: Error Angle vs Time
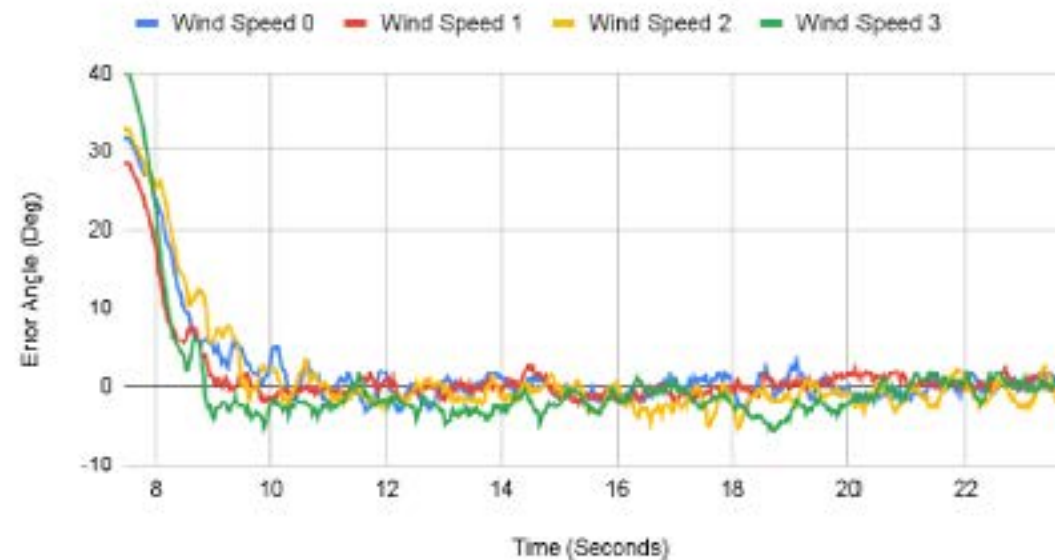
Figure 22: Manually-Tuned PID Pitch Control Loop Graph

All tests were performed at x = 23 inches as on Figure 12. Fan speeds 0 (no wind), 1, 2, and 3 were all tested to disturb the system. The best-performing loops for the RPM and pitch control at 4 different wind speeds are presented above (Fig. 21, Fig. 22). The time taken to reach a "stable position" (passes 0 deg and then oscillates about an average error angle) for the RPM control was 2.41s while it was 2.16s for the pitch control. The pitch-based control also maintained a lower magnitude average error angle than the RPM based control loop (Table 6).

Control Type	Average Angle – Wind Speed 0	Average Angle – Wind Speed 1	Average Angle – Wind Speed 2	Average Angle – Wind Speed 3
Ziegler-Nichols-Tuned RPM Control	0.340°	-1.37°	-1.56°	-2.89°
Manually-Tuned Pitch Control	-0.072°	-0.112°	-1.07°	-1.750°

Table 6: Average Error Angle by Wind Speed and Control Type

Discussion and Future Work

In terms of wind speed measurement, the anemometer's scale in comparison to the testing environment may have led to significant error. The anemometer is very small in comparison to the atmosphere, and is reasonably accurate for local measurements of wind speeds caused by weather. It cannot be expected to give as accurate of a reading in a confined space like the wind tunnel - the resolution of a hot wire anemometer is needed.

The Reynolds number of around 44,000 is smaller than expected, but still well into what would be considered turbulent. The turbulence intensity of 6.53% is within the established values in the Solberg (0.75% to 13.15%) [15] and Stanford (0.03% to 45%) [14] studies.

The servos in the study had a couple issues. Namely, sometimes when uploading the PID code they would spasm and turn to an angle that would detach them from the drone chassis, causing slight damage to the frame. While the servos were strong, they were not very accurate. Also, in Cutler's Master's Thesis [7], he explains that the servos he used had a longer response time than the ESCs. The author suspects these two factors are to blame for the servos not performing dramatically better than the PID RPM control. However, the evidence does show that there was some improvement when switching to the PID pitch control.

There is doubt on whether the most optimal PID constants were chosen in each case. This may have also made a significant impact on the performance measured in the study, as the PID pitch control may have just been better optimized.

Future work must attempt to address these concerns. This study should be validated or disproven through the use of more accurate equipment and flight hardware, and a mathematical control model should be developed to optimize the control loop for each scenario. Actuating the propeller mechanisms with more responsive and accurate hardware would most definitely improve the performance of the PID pitch controller.

Conclusion

The ability to hover and stabilize drones in turbulent environments is an emerging frontier. Using variable pitch mechanisms to control an aircraft is not a new idea, but it can be applied to new problems in this frontier. Companies are increasingly trying to find ways to make their drones more reliable for search and rescue, drone delivery and military applications. Variable pitch mechanisms address problems of control saturation, reverse thrust and efficiency.

Under turbulent conditions, variable pitch drones take less time to reach a nominal position and hold that position more closely than its fixed-pitch counterpart. This study is a starting point for future work on the topic of using variable pitch mechanisms to reject turbulence. More research is required to verify these findings.

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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 objective(s)

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 and summary of literature review

Traditionally, a quick breakfast was either an egg, oatmeal, toast, or a bowl of cereal. Due to changes in people's lifestyles and eating pattens what used to be quick a century ago, seems to not be quick enough today. 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 more at work than at home prior to the COVID-19 pandemic (Sharma, Kaur, Aggarwal, Singh. 2014). Breakfast is often called "the most important meal of the day", and proven by research, 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 nutrition and breakfast bars are constantly creating newer products promising consumers that there brand bar is the healthiest and the best option for their breakfast. An attractive wrapper that says to be "all natural", "no sugar", "fat free", 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 and disease prevention component determined by the 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 consumers consuming breakfast or cereal bars and not looking at the ingredients list, not knowing the nutritional value, or which is the best fit for their needs (Constantin, Istrati. 2018).

Most of the time, 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 that they put 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 either do not have enough calories and nutrients to serve as a breakfast meal or have the same calories as a Snicker's candy bar. Why aren't there 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, and instead consumers rely on the nutrition claims that is 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 energy, serve as weight loss aids, and promise healthy benefits, these products mislead many consumers and the cause of malnourishment and heart diseases. The making of breakfast bars with a nutrient-rich composition that gives their consumers the right amount of fiber and nutrients in one bar is difficult due to the different age requirements of energy intake and the consumers' wide-ranging nutritional knowledge. Thus, it is important to educate consumers in looking for breakfast bars and other 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 more added sugars than they believe, lack fiber, that energy means calories, and 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. A RedJade survey (IRB# 20-215) link was sent to students in the College of Agriculture to assess their preferences of breakfast bars, how often they are consumed, and which ones were the healthiest based on what they believe makes a food product a healthy choice.

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 *		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 (2.0)	3.36	2.7	(0.96, 4.51)	0.006
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	0.20	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	(8.89, 59.8)	0.017
Total Saturated	3.6	4 (1.9)	0.40	0.26	(-0.89, 1.40)	0.694
Cholesterol	5.2	0.07 (0.2)	-77	-5.1	(-5.28, -4.99)	<0.000

* 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	0	1.1 (0.28)	-66.053	-4.9	(-5.00, -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)?
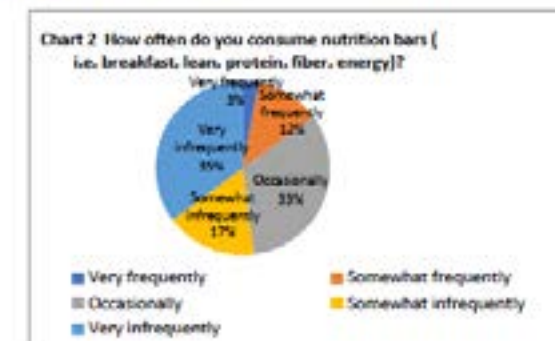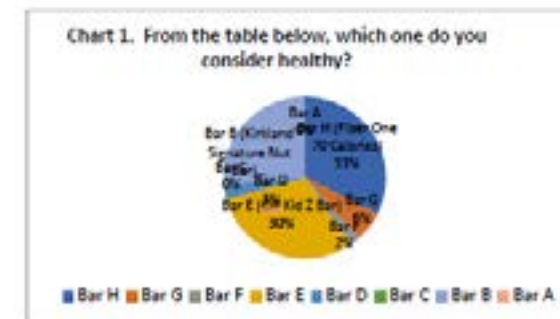
Conclusion

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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Meyersohn   Accuracy-Checks
Caroline

Summary

The goal of this research project is to get a more concrete understanding of why some people show little change in response to accuracy-checks, specifically on marketing claims made for products. We expect our research to be valuable to social scientists seeking to understand human behavior in the "post-truth" era, marketers, policy makers and product regulators, and the general public alike. Our research also brings some more understanding of misinformation both generally and in the consumer domain. While prior research surrounding falsehoods and misinformation has focused more on political issues, our research establishes a new framework that is product centered and leans into the consumer behavior side of misinformation.

Our research supports our "Red Cell" framework. Red cell thinking can be defined as a reasoning style in which across different issues, people do not discriminate between what is "correct" based on some verifiable standard and what's correct based on symbolic thinking or narrative, seeing both as relatively legitimate. The way people think about truths will affect how much of an impact an accuracy-check about claims made about a product will have. Our research supports that those with the "Red cell" reasoning style do not change their beliefs much after an accuracy check, and rather do place a higher value on the symbolism of a having a product, such as personal empowerment.

Background & Motivation

In recent years social scientists have focused attention on understanding the "post-truth" era, characterized by a slip in a shared reality of what's true and what's not (Lewandowsky, Ecker & Cook, 2017). Part of these efforts is identifying individual differences in how people reason that account for why people sometimes lean away from verifiable information and towards misinformation. For example, a lack of reflective thinking can lead people to be willing to share "fake" news (e.g., Pennycook & Rand, 2019), partisan bias can distort memories such that convenient information is misremembered as more accurate than it was (e.g., Greene, Rash & Murphy, 2021), and a belief in the power of intuitive thought can lead people to discount systematic evidence in favor of anecdotal accounts (Stein, Swan & Sarraf, 2020).

Most of this research has focused on belief in issues related to politics or science. However, the consumer behavior literature has long acknowledged that how people do (or do not) discern truth from fiction is an important part of the consumer decision process. A common theme is that people are not always moved when they find out that truth has been stretched regarding some aspect of an experience or product. Deighton & Grayson (1995) classically put forth the idea that customers will feel alright about fraud – even large-scale fraud – if they can rationalize some other benefit, such as belonging or excitement. Similarly, when customers find out that a product they use has been "greenwashed" – meaning, the marketing has over-stated the environmental friendliness of the product – their attitudes generally turn more negative, but some people manage to find rationalizations for using

them anyway, such as assuming the product still is not as bad as others (Atkinson & Kim, 2014).

Products are often sold on vaguely defined concepts like "authenticity" such that if one queue to authenticity turns out to be fake, another might be used as rationalization (e.g. clothing not made in the original factory, but still looks like it could have; Grayson & Martinec, 2004). Similarly, customers are quick to positively evaluate products labeled as "natural" despite lacking a definition of what it means, an effect that is attenuated but not eliminated when customers are told that the term is not regulated (Berry, Burton & Howlett, 2017). Additionally, vague and often outright incorrect claims have long been used to sell pseudoscientific medical products (Beyerstein, 2001; Garrett et al., 2018)

The above lines of research certainly suggests that insensitivity to truth and resistance to accuracy checks are a critical part of understanding how people are (or are not) persuaded, Therefore, the purpose of the current research is to provide a framework and empirical test of an explanation for why people, particularly in consumer contexts, differ in how they think about the nature of truth and as a result differ in their responses to being presented with factual information that a central marketing claim of a product is not true. While other reasoning constructs have focused on how people who think more intuitively or less reflexively tend to reach different conclusions than those who do the opposite (e.g., Pennycook & Rand, 2019), we focus on how people think about the nature of truth itself. We further contribute to the consumer behavior literature by presenting a novel investigation of what might lead consumers to be relatively indifferent to whether some central marketing claim about a product turns out to be false or inauthentic.

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. As such, we call the scale we utilize the "Reasoning About Reality" scale. We suggest 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 what is correct as "authored" – what's correct is a matter of interpretation and perspective, without any standard legitimizing 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 singular correct answer exists. As found by Jarrin Rueda & Stein (2021), 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 (tendencies which themselves are highly correlated).

At the other extreme, and most susceptible to misinformation, is what we call "Red Cell" thinking, wherein there ceases to be a line 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 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 correctly approximated reality and made the war seem like the correct decision. So, we use the term "Red Cell thinking" to refer to a reasoning style with a blurred distinction between applying authored and discovered ways of thinking about reality. Additionally, the greater one's tendency towards Red Cell thinking, the more susceptible one is towards misinformation, and the more one inclined is to authoritarian thinking (e.g. thinking the world is rightly divided into social classes, authoritarian personality, endorsing marginalization of certain social groups; Jarrin Rueda & Stein, 2021).

Applying this framework to the current research, consider a consumer reading an article presenting evidence that cooking tips from a YouTube video they watched do not actually work as a described. For non-"Red Cell" thinkers, their reaction should be straightforward – they no longer think the tips in the video are legitimate. However, for "Red Cell" thinkers are more liable to see all ways of approaching truth as equally legitimate, the "debunking" should lead to more muted belief change. We suggest they should effectively have a more "cynical" approach to accuracy checks, thinking nothing is knowable for sure, and exhibit relatively small opinion change.

The idea that "Red Cell" thinkers show muted belief change in response to accuracy checks is the central hypothesis of the current research. In the studies reported here, respondents are introduced to a real product, such as a YouTube cooking video, and told about some claim its marketers have made, such that the video contains time-saving cooking "hacks". Participants rate their initial belief in the claim and overall evaluation of the product. They then read an excerpt of a real press article either confirming or disconfirming the claim, and then participants again rate belief in the claim and overall evaluation of the product. The true claim conditions act as a point of comparison for the false claim condition and allow us to rule out the possibility that "Red Cell" thinkers just believe the opposite of whatever they are told (e.g., having a claim confirmed would cause them to believe it is not true) as opposed to showing muted tendencies towards belief change.

As the products and confirmations/disconfirmations are real, we use different products for both the true and false claims conditions. This means that the two conditions differ in qualitative ways besides just the truth or falsity of the claim. Therefore we present five studies using an array of products and show that similar results obtain regardless of product categories, thus showing the effects are unlikely due to quirks of any particular study. We present studies where the claim has to do with product function itself (e.g. the cooking video with questionable advice) and where the claim involves the social implications

of the product (e.g. a cleaning product with false claims about its "green" attributes).

Mediating mechanisms. Here we test two mediating mechanisms to account for the "rationalizations" that Red Cell thinkers might use to justify a lack of change in belief and change in evaluation of a product after having a central claim about it disconfirmed. The first is resorting to "symbolic" benefits of the product, meaning the product's ability to tie the customer to some aspirational identity or social group (Bhat & Reddy, 1998). Marketing on symbolic benefits is a popular strategy in part because it can be used regardless of product category (Chernev, Hamilton & Gal, 2011), since a symbol, by definition, does not require an intrinsic link to its signifier (Lutz, 1996). Symbolism, therefore, we think would be a good refuge for cynical thinking, as it is not tethered to physical reality and can exist entirely in the mind of the beholder. Additionally, we have collected other evidence that Red Cell thinking is associated with concern over symbolic threat and social hierarchy (Jarrin Rueda & Stein, 2021).

The second mediator we propose is thinking accuracy checks themselves are unfair. Since we define Red Cell thinking in part by the assumption that all ways of approximating the truth are legitimate, fact checkers are in essence "spoil sports". Additionally, Red Cell thinkers tend to feel negatively about attempts at business regulation (Jarrin Rueda & Stein, 2021), and accuracy checks could be seen as a de facto way to regulating what businesses can say in order to sell products.

We include tests of these mediators in all five studies. We loosely hold the hypothesis that symbolic benefits will be the primary mediators for products in which the central claim involves functional benefits of the product itself, since symbolic benefits can be used as a way of making up for functional deficits (e.g., "It doesn't matter if this cooking video is fake, watching it still makes me feel empowered"). However, for products in which the central claim involves social consequences of using the product, we expect concerns about business regulation to be heightened, and therefore unfairness of accuracy checks would be the primary mediator.

Methods (Studies A – E)

 Participants and procedure

This study was programmed in Qualtrics and took about 15 minutes to complete. Participants from the United States were recruited from Prolific Academic (N = 1486). Before beginning the survey, participants needed to consent to the survey and answer two basic attention check questions.

Measures

Red Cell Questionnaire. To begin, participants fill out the Reasoning About Reality scale. In this set of questions, participants are asked how much they agree or disagree with different issues on a 9-point scale. There are a total of 15 "issues" that are evenly divided into three categories: personal opinions (e.g., how funny a movie is), social science issues (e.g., the causes of unemployment), and physical science issues (e.g., how lightbulbs work).

Upon completing this questionnaire, we can determine their reasoning style as either "authored", meaning that what is "correct" is created by perspective or interpretation, or as "discovered" where what is correct can be found or verified. All items and instructions for this part of the survey can be referenced in the Appendix.

Fakery Items (overview). Upon completing the Red Cell Questionnaire, participants were randomly assigned to one of 5 different studies. Each study contained a 2 (within subjects: before and after ratings) X 2(between subjects: false claim vs. true claim) design, with two within-subjects dependent variables (ratings of belief in the claim and overall product value, before and after claim [dis]confirmation), and scores on the Reasoning About Reality scale as an additional individual difference independent variable. In each study, participants are presented first with information about a certain product and the claims the brand makes about their particular product. After reading this initial information, participants are asked how familiar they were prior to reading, and completed initial ratings of belief in the claim and perceived value of the product.

The next portion presents additional information about the product. Here, a third-party reviews or "fact-checks" the claims being made by the brand. This additional information will reveal the fakery or misleading nature of the product. Participants then again rated their belief in the claim and perceived value of the product, as well as several questions about perceived benefits of the product, including symbolic benefits (e.g., this product can help one feel one feel empowered). The next set of questions focuses on their opinions on the purpose of the additional information/ "fact-check" and accuracy. These statements are also on a 9-point scale. (e.g., People criticizing X for accuracy are missing the point, it does not matter if X claims are accurate). Lastly, participants are asked how likely they believed that the author of the additional information/ "fact-check" presented information that was not true, and how likely they believed that the author of the additional information/ "fact-check" left out important information.

Pre-tests for all different scenario types were launched with smaller sample sizers to ensure reliability of measures. The product scenarios included products marketed toward sustainability or being environmentally friendly, products that are marketed as humane, a "cooking hack" video/article, pop-punk bands that markets itself as edgy and authentic, non-prescription medical products, animal products marketed as "humane" and cleaning products marketed as "sustainable".Some participants are shown an "honest" condition with a similar kind of product, that makes similar claims as the fakery one except, there is no dishonesty in this scenario.. The same corresponding questions are presented in this scenario. Additional third-party information is also provided to affirm the authenticity of the product. Post-fact check questions are also presented as they were with the corresponding fakery scenario. All questions for each scenario can be found in the Appendix, and an overview of the studies is in Table 1.

Study A: Cooking Hack. In this study, participants in the "false claim" condition were first presented with some introductory information about a YouTube media channel called "5-Minute Recipes". These videos present unconventional but seemingly simple cooking videos and ideas. After collecting familiarity and initial ratings on the product, participants are presented with additional information from an article from The Eater, and reporter Chris

Fox, testing and debunking the "hacks" and revealing the fakery in the video. According to the article the final-product recipes in the videos from "5-Minute Recipes" fail , and do not appear as advertised.

In the "true claim" condition, participants are then presented with an article containing a food hack from Chowhound. Following initial ratings, presented with additional information from a Food52 food article that tests one of their cooking hacks and claims that it works well and performs as advertised. Following this, participants complete initial ratings again as well as the Functionality Questionnaire and the Resistance to Fakery Questionnaire.

Study B: Pop-punk band. In this Study, for the false claim condition participants are first introduced to pop-punk band Tramp Stamps along with information about how the band formed ("three girls got drunk at a bar and wrote a song") and how the band markets themselves. Familiarity and initial ratings are collected. Then additional information is presented from Vox, questioning the authenticity of the bands formation, putting and emphasis on the idea that they are "industry plants". After being presented with this additional information, participants post-accuracy check ratings are collected.

In the true claim condition, participants read about the pop-punk band Doll Skin. Participants are presented with an article detailing their formation as high-school students competing in a musical contest. After collecting data about participants familiarity an initial rating of the band, they are presented with an article from Vice confirming and elaborating on their origins story as well as reviewing their work, after which post-accuracy check ratings were collected.

Study C: Medical product. In this Study, in the "False claim" condition participants are presented with 2 products from the "lifestyle" website associated with Gwyneth Partlow, goop. The first product is a set of "Body Vibes" stickers that claim to "promote healing". Participants respond with their familiarity with both goop and Body Vibes healing stickers as well as their initial ratings. Then, participants are presented with an article from Business Insider detailing how the claims of the product are not based in science and that the product is a "health fad". Following this, participants post-accuracy check ratings were recorded.

In the "true claim" condition participants read about another product sold on goop's website: Hum Nutrition Vitamin D3 supplements. As with the Body Vibes stickers, participants respond to questions about their familiarity with the product, and initial rating. Then, participants read an article from the National Institute of Health Fact Sheet explain the health benefits of Vitamin D3 supplements, affirming the claims made from Hum Nutrition as true. Participants are then presented with post-accuracy check ratings

Study D: Animal Product. In this study, in the "false claim" condition participants were presented with two animal-based food products that market themselves as "humane". The first is Sparboe eggs. Participants read some claims about Food safety and Quality and their Animal Code of Conduct featured from their website. Then, participants provide information on their familiarity with Sparboe eggs, and their initial ratings. Participants are then presented information from ABC News explaining how Sparboe eggs keeps its hens in subpar conditions and got into some trouble with the FDA. After reading this, participants

post-accuracy-check ratings

In the "true claim" condition participants are presented with is a pork meat product from La Quericia and read about how they acquire their meat from their website. Familiarity and Initial ratings are collected. Then participants read from the Global Animal Partnership (G.A.P) and their requirements for animal welfare, specifically their "level 4" standards for pasture raised animals, which La Quercia is a part of. After reading this participants ratings are collected and they completed post-accuracy check ratings.

Study E: Cleaning Products. In the "false claim" condition of this study, participants are presented with cleaning products from Mrs. Meyers. They are presented with claims about this product from one of their advertisements. Initial ratings and familiarity are collected Then, participants read an article from Vox explaining how Mrs. Meyer's is "greenwashing" and uses many synthetic harmful ingredients. Following this, participants completed the post-accuracy check ratings.

In the "true claim" condition, participants read about Humankind Shampoo bars and their sustainability claims about no single use-plastic, recycling and being carbon neutral. Participants initial ratings and familiarity are collected. Then participants read an excerpt of an article from "Reviewed.com" reviewing the product and how the goals Humankind has of being environmentally-friendly are met. Post-fact check ratings are collected and followed up by the Functionality Questionnaire and Resistance to Fakery Questionnaire.

Table 1. Summary of Studies

Study	Product category	Product description (Fakery)	Product Claim (Fakery)	Product Description (Non-Fakery)	Product Claim (Non-Fakery)
A	Cooking "hack" videos	5-Minute Recipes. Short YouTube cooking videos.	Easy unconventional cooking hacks with great end-results.	Chowhound: Cooking hack article.	Cooking hacks meant to make cooking easier and more efficient.
B	Pop-punk bands	Tramp Stamps: pop-punk band gaining popularity on Tiktok.	Tramp Stamps formed authentically when "3 girls got drunk at a bar and wrote a song".	Doll Skin: pop-punk band	Doll Skin formed when members competed in and won high school music contest.
C	Medical products	Body Vibes stickers, sticky patches attached to the body	Body Vibes stickers promote healing by rebalancing energy frequency in our bodies.	Hum Nutrition Vitamin D3 supplements.	Hum Nutrition Vitamin D3 supplements support cellular health and strong bones.
D	"Humane" animal products	Sparboe eggs: chicken eggs	Sparboe Farms eggs high quality and don't make the hens suffer	La Quercia pork meat products	La Quercia meat is humane and follows G.A.P animal welfare standards.
E	"Green" cleaning product	Mrs. Meyers cleaning products such as dish soap.	Mrs. Meyers uses earth-friendly ingredients that are plant-based and essential oils for fragrance	Humankind Shampoo bars, shampoo in bar form.	Humankind shampoo bars are environmentally friendly by not using single use plastic, being recyclable, and carbon neutral.

Other measures. For exploratory purposes, at the end of each product scenario, for exploratory purposes participants are presented with two questions concerning the reporting of the accuracy check. Participants are asked if they believe the authors wrote the accuracy check knowing what they were writing was false and if they believed the media article that did the fact check purposely left out information.

We also had respondents the Feelings Are Truth scale (Stein, Swan & Sarraf, 2020) measuring belief in the power of intuitions, and the Actively Open-Minded Thinking scale (Haran et al., 2013) measuring people's attitudes towards whether changing attitudes with respect to evidence is good or bad.

Demographics. Finally, at the end of the survey, basic demographic questions was collected.

Results

Descriptive statistics. Reliabilities of key metrics in each study are in Table 1. All metrics showed good reliabilities, with most above .80.

Table 2. Reliabilities of key metrics.

	Scales shared across studies									
Reasoning About Reality	.89									
Active Open-Minded Thinking (AOT)	.80									
Feelings Are Truth (FEAT)	.84									
	Cooking Hack (Study A)		Pop-punk band (Study B)		Medical product (Study C)		Animal Product (Study D)		Cleaning Product (Study E)	
Condition	False	True	False	True	False	True	False	True	False	True
Initial claim belief	.82	.86	.89	.85	.92	.91	.90	.78	.81	.82
Second claim belief	.82	.83	.90	.92	.96	.88	.80	.84	.89	.82
Initial value	.80	.87	.84	.84	.92	.82	.80	.79	.68	.71
Second value	.88	.80	.86	.86	.96	.80	.85	.81	.83	.70
Symbolic benefits	.92	.92	.93	.93	.95	.90	.97	.95	.95	.95
Unfairness of accuracy check	.91	.82	.90	.98	.75	.80	.87	.79	.88	.73

Averages of the dependent variables and mediators by condition are in Table 3. This table shows that the manipulations worked as intended, as respondents gave more negative evaluations of both the claim and the product itself after learning that the claim was false. When finding out the claim was true, participants showed a more modest positive change, indicating that participants largely considered the confirmatory articles as backing up what they already assumed. Interestingly, participants' evaluations of the "humane" animal product (La Quercia meats) became more negative after reading what as intended to be an affirmation of La Quercia's ethical standards, indicating that participants' own assumed standards were perhaps higher than those of the rating agencies. Nonetheless, the drop was still larger in the "false claim" condition, so in that condition the manipulation still worked as intended.

Additionally, evaluations of products and claims in the "false claim" condition tended to be more initially negative than those in the "true claim" condition, indicating that there is likely something suspicious-sounding about claims that do in fact turn out to be false.

Table 3. Belief in product's claim (before/after claim evaluation), valuation of product (before/after claim evaluation, rating of product's symbolic benefits, and rating of unfairness of accuracy checks by condition (False claim = respondent sees article disconfirming claim, True claim = respondent sees article confirming claim), and by Study. p < .001, p < .05

		Study A Cooking video	Study B Pop-punk Band	Study C Medical product	Study D Animal product	Study E Cleaning product
Initial claim belief	False claim	5.93 (1.81)	5.96 (2.09)	3.06 (2.07)	7.33 (1.61)	6.79 (1.66)
	True claim	6.63 (1.50)	6.91 (1.43)	5.49 (1.67)	6.79 (1.76)	7.27 (1.60)
	t	-3.66	-4.61	-11.16	2.78	-2.55
After claim belief	False claim	3.49 (2.33)	4.23 (2.15)	2.2 (2.01)	2.54 (2.12)	3.68 (2.15)
	True claim	6.68 (1.68)	7.13 (1.59)	6.08 (1.64)	5.51 (2.47)	7.54 (1.52)
	t	-13.52	-13.24	-18.23	-11.10	-17.85
Claim belief change	False claim	-2.44 (2.31)	-1.72 (2.23)	-0.86 (1.74)	-4.8 (2.74)	-3.11 (2.34)
	True claim	0.04 (1.14)	0.22 (1.11)	0.59 (1.20)	-1.27 (2.43)	0.28 (0.85)
	t	-11.75	-9.55	-8.35	-11.70	-16.47
Initial valuation	False claim	5.75 (1.96)	5.02 (2.11)	2.86 (2.20)	6.32 (1.69)	6.87 (1.78)
	True claim	6.08 (1.92)	6.31 (1.65)	4.76 (2.01)	6.33 (1.75)	6.29 (2.08)
	t	-1.46	-5.90	-7.75	-0.09	2.59
After valuation	False claim	3.91 (2.30)	4.96 (2.08)	2.15 (2.04)	2.79 (1.94)	4.49 (2.25)
	True claim	6.56 (1.85)	6.94 (1.60)	5.6 (1.94)	6.83 (1.68)	6.56 (1.90)
	t	-10.92	-9.24	-14.83	-19.04	-8.59
Valuation change	False claim	-1.83 (2.24)	-0.06 (1.49)	-0.71 (1.74)	-3.53 (2.60)	-2.38 (2.19)
	True claim	0.48 (1.04)	0.62 (1.01)	0.86 (1.39)	0.5 (1.07)	0.28 (1.35)
	t	-11.47	-4.64	-8.52	-17.37	-12.53
Symbolic benefits	False claim	3.27 (2.35)	4.32 (2.1)	2.35 (2.09)	2.15 (1.92)	3.38 (2.09)
	True claim	4.93 (2.16)	6.15 (1.82)	4.95 (2.03)	4.96 (2.07)	6.16 (2.20)
	t	-6.36	-8.04	-10.89	-12.08	-11.16
Accuracy check unfairness	False claim	2.88 (1.94)	4.89 (2.04)	2.85 (1.59)	2.55 (1.75)	2.90 (1.74)
	True claim	3.19 (1.58)	5.30 (1.81)	2.76 (1.55)	3.55 (1.70)	3.76 (1.71)
	t	-1.50	-1.80	0.52	-4.97	-4.32

Main analyses. The central prediction of the analyses reported here is that the change in beliefs about and valuations of the products in each study is moderated by scores on the Reasoning About Reality scale, with lower scores (the "Red Cell") being associated with smaller change.

We tested this two ways. First, for each study we conducted a repeated-measures ANOVA for each dependent variable (claim belief and product valuation) with rating (before vs. after) as a within-subjects independent variable, condition (false vs. true claim) as a between-subjects independent variable, and Reasoning About Reality Scale as a continuous independent variable. The key prediction is that we would find a 3-way interaction among all three independent variable. The within-subjects effects of these ANOVAs are in Table 3. The predicted three-way interactions were significant or marginal in all but one instance (Study B, product evaluation as dependent variable).

Table 4. Within-subjects ANOVA results of each study $p < .001, p < .05$

Dependent variable: Belief in claim	Cooking Hack (Study A)		Pop-punk band (Study B)		Medical product (Study C)		Animal Product (Study D)		"Green" Product (Study E)	
	F	p	F	p	F	p	F	p	F	p
Rating (before/after)	2.25	.13	1.93	.17	.12	.73	17.72	<.001	14.87	<.001
Rating * Reasoning About Reality Scale	10.61	<.001	29.58	<.001	1.25	.26	35.14	<.001	3.99	.05
Rating * Condition (false vs. true claim)	4.14	.04	.42	.52	2.52	.11	16.47	<.001	20.79	<.001
Rating * Reasoning About Reality Scale * Condition	8.11	<.001	20.47	<.001	4.70	.03	2.89	.09	6.19	.01
Dependent variable: Product evaluation										
Rating (before/after)	.33	.57	14.70	<.001	2.03	.15	12.07	<.001	18.28	<.001
Rating * Reasoning About Reality Scale	4.88	.03	5.21	.02	1.51	.22	7.83	.01	.07	.80
Rating * Condition (false vs. true claim)	6.46	.01	.74	.39	2.72	.10	23.40	<.001	13.22	<.001
Rating * Reasoning About Reality Scale * Condition	4.46	.04	2.02	.16	4.49	.03	11.89	<.001	3.04	.08

The second way of testing this prediction was via regressions using both dependent variables conducted via PROCESS (Hayes, 2018) with independent variables including condition (false vs. true claim), the Reasoning About Reality scale, and their interaction, and initial ratings as covariates. The key prediction is finding a significant interaction in each regression. These results are in Table 4. Results largely mirror Table 3, the predicted interaction is significant or marginal in all instances.

Table 4. Between-subjects regression results for each Study. Initial ratings were included as a covariate. $p < .001, p < .05$

Dependent variable: Change in belief in claim	Cooking Hack (Study A)		Pop-punk band (Study B)		Medical product (Study C)		Animal Product (Study D)		"Green" Product (Study E)	
	B	p	B	p	B	p	B	p	B	p
Initial rating	.38	<.001	-.25	<.001	-.30	<.001	-.71	<.001	-.46	<.001
Condition (false vs. true claim)	.96	.05	.41	.17	1.19	.01	1.95	<.001	2.13	<.001
Reasoning About Reality Scale	-.73	<.001	-.25	.01	-.53	<.001	-.73	<.001	-.57	<.001
Condition * Reasoning About Reality Scale	.38	<.001	.13	.03	.27	<.001	.27	.02	.31	<.001
Dependent variable: Change in product evaluation										
Initial rating	-.36	<.001	-.37	<.001	-.37	<.001	-.61	<.001	-.36	<.001
Condition (false vs. true claim)	1.00	.03	.69	.07	1.20	.01	2.37	<.001	1.67	<.001
Reasoning About Reality Scale	-.59	<.001	-.70	<.001	-.50	<.001	-68.00	<.001	-.27	.07
Condition * Reasoning About Reality Scale	.56	.01	.56	<.001	.24	.01	.57	<.001	.17	.08

To explore the nature of these interactions, we trichotomized scores on the Reasoning About Reality scale (with those on the low end representing the "Red Cell") and plotted the before and after scores for both dependent variables for each study. These plots are in figures 1 and 2.

The plots largely show that, as expected, in the "False claim" conditions, the "Red Cell" participants show muted tendencies to change their beliefs. The same does not happen for the "True claim" conditions, for which participants at all three levels of the Reasoning About Reality scale tend to show a small increase in belief or evaluation, thus showing that "Red Cell" thinkers do not necessarily reject whatever they read, overall showing that "Red Cell" thinkers generally show muted belief change while other respondents show large changes for disconfirmations and muted changes for confirmations.

Figure 1. Belief in claim before and after (dis)confirmation, by Reasoning About Reality scale scores (Low scores = "Red cell")
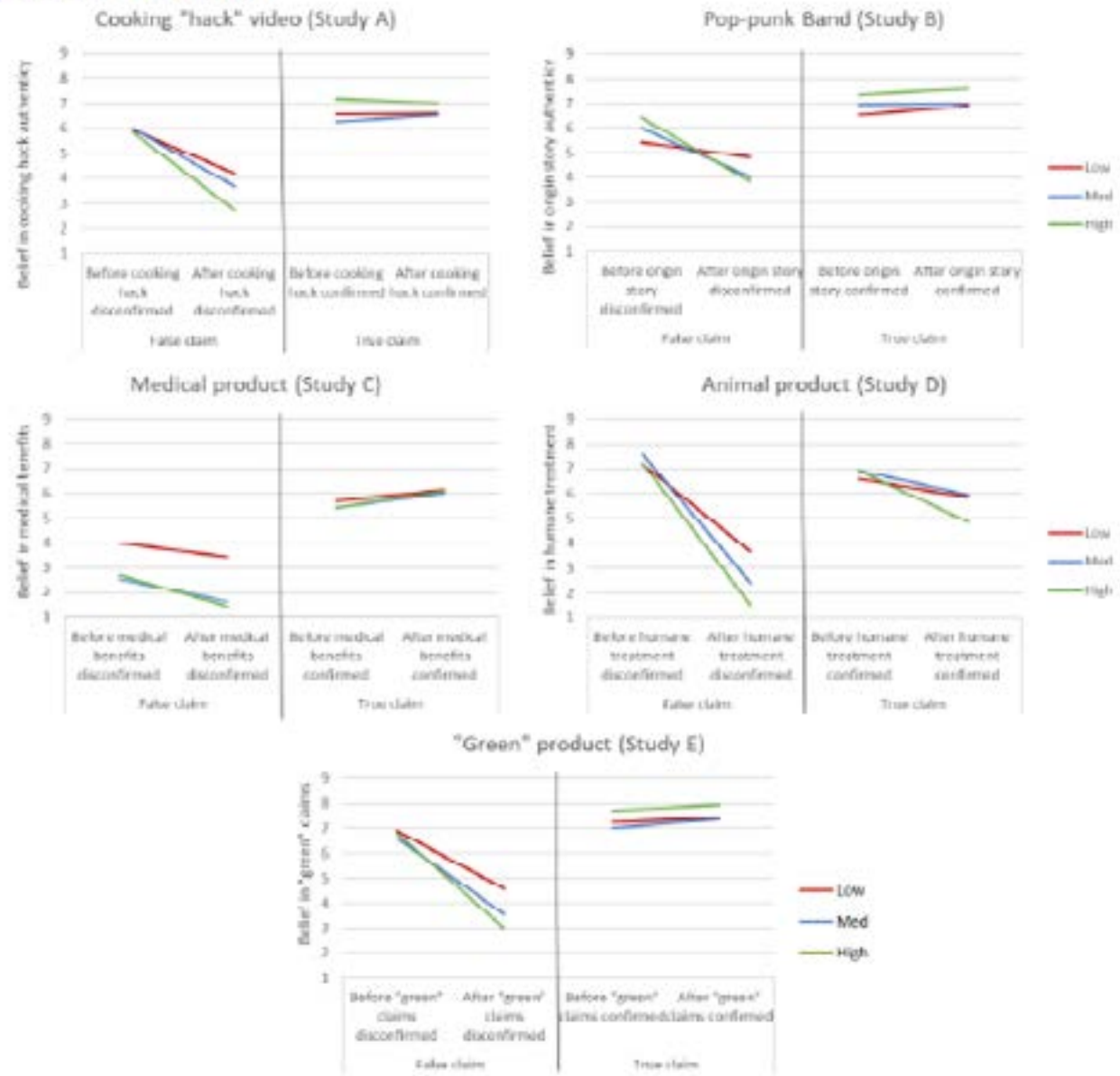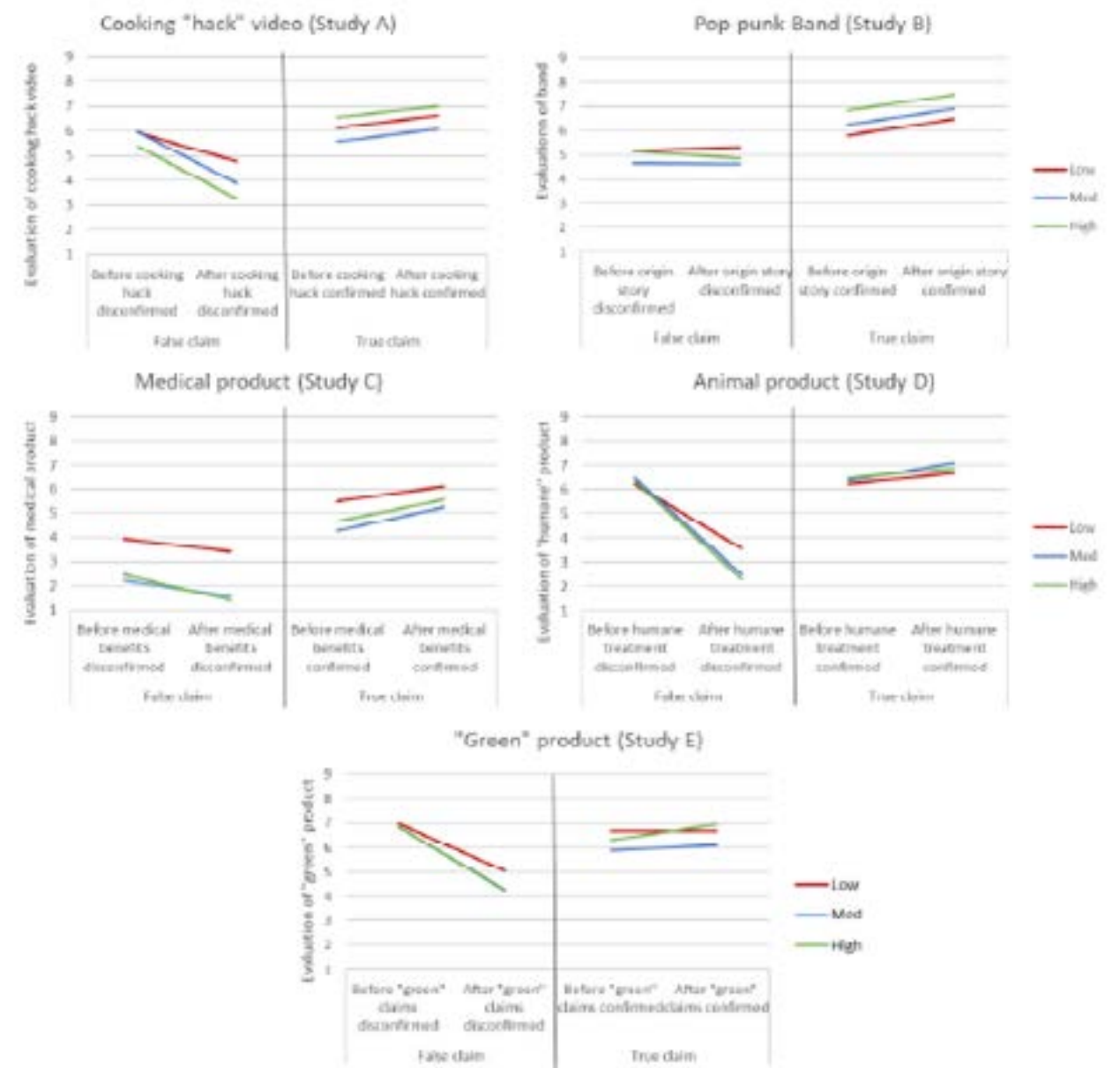

Figure 2. Product evaluation before and after (dis)confirmation, by Reasoning About Reality scale scores (Low scores = "Red cell")

Mediation Effects. We tested two mechanisms by which Red Cell thinking leads to attenuated belief change in the false claims conditions for each study, thinking the product provides symbolic benefits and thinking accuracy check are unfair. We used PROCESS to test a moderated parallel mediation model in which the Reasoning About Reality scale predicts the two mediators, which in turn interacts with condition to predict change in belief in the claim, with initial belief as a control variable.

The results of these models are in Table 5. As stated in the introduction, we had loose expectations that symbolic benefits would be a significant mediator for products where the claim was about functional benefits (Studies A, B, and C), while accuracy check unfairness would be a significant mediator for products where the claim has to do with social consequences of using the product (Studies D and E).

These expectations were partially met. As expected, symbolic benefits was a significant mediator for Studies A, B, and C. However, accuracy check unfairness was also a significant mediator for Study A (with a larger effect size than symbolic benefits). Additionally, accuracy check unfairness was a significant mediator in Study D, while we found support for neither mediator in Study E. Thus, our specific predictions received some support, as well as support for the more general idea that symbolic benefits and accuracy check unfairness are potentially ways of rationalizing a lack of belief change in response to reading a disconfirmation.

Table 5. Moderated mediation effects in each study. Path tested is that scores on the Reasoning About Reality scale (independent variable) predicts symbolic benefits and accuracy check unfairness (mediators, tested in parallel) which in turn interact with study condition (false vs. true claim; moderator) to predict change in claim belief (dependent variable). Initial claim belief is included as a control variable.

	Indirect effect		Direct effect
	Symbolic Benefits	Accuracy check unfairness	
Cooking Hack (Study A)	.08 [.01, .17]	.22 [.13, .33]	.05 [-.04, .13]
Pop-punk band (Study B)	.04 [.01, .08]	.01 [-.02, .05]	-.04 [-.11, 03]
Medical product (Study C)	.04 [.01, .08]	.04 [-.03, .12]	.02 [-.06, .09]
Animal Product (Study D)	-.09 [-.19, .01]	.10 [.01, .20]	-.02 [-.11, .06]
"Green" Product (Study E)	.01 [-.09, .09]	01 [-.03, .06]	2.55 [2.16, 2.95]

Discussion & Conclusion

Across five studies we supported the hypothesis that "Red Cell" thinking is associated with muted belief change in response to disconfirmations of a claim about a product. Even when reading reporting that a central claim about a product (e.g., a band's supposed origin story, or claims about how humanely-produced some eggs are) is false, "Red Cell" thinkers whose reasoning is characterized by a blurred distinction what is verifiable and what is open to interpretation show relatively small change in belief, and also relatively small change in how much they value the products. We also found evidence for two mediating mechanisms, namely thinking the product provides symbolic benefits and thinking accuracy checks are unfair.

These studies contribute to social science literatures in several ways. First, we have identified why some consumers might be fine with (or relatively unphased by) finding out some aspects of the consumer aspect are inauthentic or just untrue. Most scholarship in this area has been more theoretical than empirical (e.g., Deighton & Greyson, 1995) and empirical work that does exist has identified scattered effects without an overarching framework (e.g., Berry, Burton, & Howlett, 2017). We have provided a framework and a scale for predicting which consumers will be generally unphased by "fakery" in product experiences.

Second, we have provided a new framework for thinking about how people reason that directly addresses how people think about reality, and here validated that our scale for measuring it does predict a kind of epistemic cynicism. Other reasoning constructs recently invoked in the literature on belief change in misinformation would struggle to explain our effects theoretically, even if they explained them statistically. Saying our results are due to intuitive thinking, for example, might superficially appear to fit since intuitive thinking is linked to believing in misinformation (Pennycook & Rand, 2020). However, these findings are often explained by intuitive belief bias, wherein intuitive thinkers tend to automatically believe whatever propositions they believe (Pennycook et al., 2013). Such a perspective would not parsimoniously explain why intuitive thinkers would resist believing in what we read, as we observed here.

Similarly, active open-minded thinking (AOT) has also been implicated in studies of how people respond to corrections of information online (Martel, Mosleh & Rand, 2021). AOT certainly shares similarities with our Reasoning About Reality scales in that both assess epistemic meta-beliefs, but whereas the AOT scale involves asking people about how they respond to evidence relevant to strongly-held beliefs, our scale more generally assesses meta-beliefs about the nature of truth itself using almost mundane subject matter unlikely to be of much personal interest. Therefore we expect, but also need to do further research to verify, that our scale applies to more contexts than AOT.

Perhaps the broadest implication of this research is that many consumers' preferences and product evaluations are relatively untethered to the reality of the actual functional benefits of products. Beliefs that products instead provide symbolic benefits might be genuine, but given that such beliefs are also in the eye of the beholder they are also arguably more open to manipulation, leaving some consumers vulnerable, especially

when they symbols involve not-quite-definable and always slightly-out of reach concepts like "authenticity".

Additionally, we believe we have also shed light on why some brands are able to endure being exposed for "greenwashing" or "humanewashing", namely that some customers are relatively unfazed by the fakery. In our studies, respondents learned about the fraud soon after finding out about the product for the first time, meaning they had little opportunity to form a strong positive impression. However, if the framework we proposed here were stretched over time, consumers could develop favorable attitudes towards a project after they see it advertised as "green" or humane, and then "Red Cell" thinkers would retain those positive attitudes even after the product is exposed. Longitudinal studies would be needed to establish this, as the current study cannot speak to this.

Additional work is also needed to tie the Red Cell thinking to how people respond to corrections of misinformation more generally. One straightforward prediction is that Red Cell thinkers are worse than other people when it comes to telling "fake" news from real news. However, since other constructs have already been implicated for that purpose, a more fruitful avenue would be showing if Red Cell thinking is tied to "backfire" effects (Nyhan et al., 2014), in which corrections cause people to double-down on what they initially thought. After initially being discovered, most attempts at replication have shown backfire effects to be elusive, with researchers largely concluding they do not exist (Ecker, Lewandowsky & Chadwick, 2020). We suggest the demise of backfire effects might be premature, in that researchers might not have been looking for the right subgroup of people (Red Cell thinkers) who might exhibit them.

Lastly, we suggest further research is needed to explore when people think accuracy checks are fair or unfair. How people reason about truth is one important factor, but certainly there are others, and we think one major area for future research is looking at how people's trust in institutions and beliefs about how normative falsity in marketing is shape how they think marketing should be regulated and what they think the media's role in exposing and regulating marketing should be. One prediction is that prior exposure to a particular egregious fraud makes people less punitive towards merely being misled, because such a sequence highlights how misleading statements are qualitatively different from lies (cf. Walker et al., 2021).

In conclusion, the current set of studies show that people differ with how they change beliefs after corrective information regarding product claims, and our results suggest that some people are relatively insensitive to what the factual truth seems to be. This suggests that people have quite different experiences consuming what we think is relatively straightforward media reports. If these same effects apply in other contexts, we believe we would have made a significant contribution to why people lack a "shared reality" of even basic rules separating what is real from what is not.

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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)

• 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: AOT

Please rate the extent to which you agree with the following statements. (1 = Strongly disagree, 9 = Strongly agree)

• I have no patients for arguments I disagree with.
• I often tune out messages I disagree with.
• I believe it is a waste of time to pay attention to certain ideas.
• I try to reserve judgment until I hear arguments on both sides of an issue.
• I am open to consider other viewpoints.
• When thinking about an issue, I consider as many different opinions as possible.

Scale 3: Feelings about truth

Please rate the extent to which you agree with the following statements. (1 = Strongly disagree, 9 = Strongly agree)

• People know deep down what's true, and what's not.
• Some people have intuitive senses of what is true and what is not.
• A gut belief that something is not true is a good reason to believe it's not true.
• Intuition can reveal more truth about a situation than objective facts.
• Gut feelings are a kind of truth.

Scale 4: Product Scenarios

Study A. Cooking Hacks

In this part of the study we'd like to ask you for your views on "5-Minute Recipes", a popular YouTube channel known for producing often-viral videos that feature recipes and cooking techniques often referred to as "hacks". Below is a screen shot of their "About" page of Youtube.

What is your familiarity with 5-Minute Recipes videos prior to reading this?

• I have watched at least one 5-Minute Recipes video
• I have heard of 5-Minute Recipes videos, but have never watched one
• I've never heard of 5-Minute Recipes videos before
• Not sure.

If you were picking a cooking video to watch, how interested would you be in watching a 5-Minute Recipes video? (1 = Not at all interested, 9 = Very Interested).

On the whole, do you think 5-minute Recipes provides a good experience for their audience? (1 = Not at all, 9 = Definitely). (Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following?

• The instructions in 5-Minute Recipes videos are practical.
• The instructions in 5-Minute Recipes videos work as described.
• (Note: preceding two items comprise rating of initial claim belief)
• 5-Minute Recipes videos are entertaining.
• 5-Minute Recipes videos are fun.

We'd now like to give you a bit more information on 5-Minute Recipe videos. Below is an except from an Eater.com article on controversy surrounding 5-minute videos, specifically about how techniques and recipes featured in the videos do not actually work. From the Eater article: Many of YouTube's Most Popular Kitchen Hacks Are Hoaxes

"You've seen them populating your Facebook feed or popping up on YouTube: those viral videos [from the likes of 5-Minute Recipes] of "food hacks" and "kitchen tricks" that seem to promise transformative results from suspiciously easy steps. Unsurprisingly, those tricks — flan from a milk carton! jelly from gummy bears! popcorn from an ear of corn! — do not actually work, technology reporter Chris Fox reveals in a video for BBC in which he debunks several viral food hacks.

Fox also cites the work of food scientist Ann Reardon, who exposes food hoaxes on her own YouTube channel. "It's the fake news of the baking world," says Reardon. The reason it works, according to the food scientist, is that clickbait still has a huge advantage in the algorithm-ruled worlds of YouTube and Facebook.

As Greg Morabito wrote for Eater: "Recipe testing is [...] a process that requires extra time and resources, and many viral food hacks and 'how to' tutorials don't need to actually be cookable to become wildly popular on the internet, anyway."" Having read this information, please answer the questions below. Now, if you were picking a cooking video to watch, how interested would you be in watching a 5- Minute Recipes video? (1 = Not at all interested, 9 = Very Interested). Now, On the whole, do you think 5-minute Recipes provides a good experience for their audience? (1 = Not at all, 9 = Definitely). (Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely).

• The instructions in 5-Minute Recipes videos are practical.
• The instructions in 5-Minute Recipes videos work as described.
• (Note: preceding two items comprise second rating of claim belief)
• 5-Minute Recipes videos are entertaining.
• 5-Minute Recipes videos are fun.
• Watching 5-minute Recipes videos would help me feel empowered.
• Watching 5-minute Recipes videos would make me feel like I can easily transform myself into a cook.
• 5-Minute Recipes videos could connect me to a more ideal lifestyle.
• Watching 5-Minute Recipes videos could make me feel authentic.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with each of the following statements about "cooking hacks" like this. (1 = Strongly disagree, 9 = Strongly agree)

• It's silly to check cooking hacks for accuracy.
• For readers, it doesn't matter all that much whether cooking hacks are accurate.
• People criticizing cooking hacks for accuracy are missing the point.
• People criticizing cooking hacks are closed-minded.
• Checking cooking hacks for accuracy puts unfair limitations on business's rights to publish whatever they'd like.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following?

• The writer of the story from on the previous page presented information about 5-Minute Recipes he or she knew was not true.
• The story from the previous page left out important information.

In this part of this survey we would like to ask you on your views on Chowhound, a food website brand that often posts cooking tips known as "hacks". Below is a screenshot of a food hack posted on an article titled: 51 Kitchen and Foods Hacks That Will Change Your Life.

28. Squeeze Spinach with a Sushi Mat or Potato Ricer

Chowhound

Smooshing thawed spinach in a strainer or wringing it out in a paper towel is messy and not very effective—but if you have either of the aforementioned kitchen tools, you're golden. You can easily remove the excess water in thawed spinach by rolling it in a sushi mat lined with a paper towel or gently squashing it in a potato ricer. This trick comes in handy when you're making something like Easy Spinach Lasagna, spinach dip, Saag with Tofu, Greek Spinach and Feta Pies, and other recipes that call for frozen spinach to be thawed and drained.

What is your familiarity with Chowhound food articles prior to reading this?

• I have read at least one Chowhound food article.
• I have heard of Chowhound food articles but have never read one.
• I've never heard of Chowhound food articles before.
• Not sure.

If you were picking a cooking video to watch, how interested would you be in reading a chowhound food article? (1 = Not at all interested, 9 = Very Interested).

On the whole, do you think Chowhound provides a good experience for their audience? (1 = Not at all, 9 = Definitely).

(Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following?

•The instructions in Chowhound food articles are practical.
•The instructions in Chowhound food articles work as described.
(Note: preceding two items comprise rating of initial claim belief)

•Chowhound food articles are entertaining.
•Chowhound food articles are fun.
We would like to give you more information about Chowhound food articles.

Below is an excerpt from a Food52 article: We Tested out 21 Viral Internet Food Hacks-& Some Really Do Work!

From their article:

"So, for the sake of faith in internet tips, we put 21 of the "hacks" we've seen circulating the web to the test—and lo and behold, some of them really do work (...and then there are those that don't). We've separated out the winners from the (no offense) losers."

ChowHound was one of their "winners", as they found the potato ricer "hack" to be successful. From their article (with picture below):

"On ChowHound's list of 47 Kitchen and Food Hacks That Will Change Your Life, they told us that potato ricers (and food mills and sushi mats) can effectively extract water from cooked spinach. And they weren't lying! (Though change my life, I'm not so sure.)"

Having read this information please answer the following questions below. Now, if you were picking a cooking video to watch, how interested would you be in watching a (1 = Not at all interested, 9 = Very Interested).

Now, On the whole, do you think 5-minute Recipes provides a good experience for their audience? (1 = Not at all, 9 = Definitely).

(Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely).

• The instructions in Chowhound food articles are practical.
• The instructions in Chowhound food articles work as described.
(Note: preceding two items comprise second rating of claim belief)

• Chowhound food articles are entertaining.
• Chowhound food articles are fun.
• Reading Chowhound food articles would help me feel empowered.
• Reading Chowhound food articles would make me feel like I can easily transform myself into a cook.

• Chowhound food articles could connect me to a more ideal lifestyle.
• Reading Chowhound food articles could make me feel authentic.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with each of the following statements about "cooking hacks"
like this. (1 = Strongly disagree, 9 = Strongly agree)
• It's silly to check cooking hacks for accuracy.
• For readers, it doesn't matter all that much whether cooking hacks are accurate.
• People criticizing cooking hacks for accuracy are missing the point.
• People criticizing cooking hacks are closed-minded.
• Checking cooking hacks for accuracy puts unfair limitations on business's rights to publish whatever they'd like.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following?
• The writer of the story from on the previous page presented information about Chowhound food articles he or she knew was not true.
• The story from the previous page left out important information.

Study B. Pop-punk Bands

Below is an image of a new pop-punk band called Tramp Stamps.

According to their official website, their members are Marisa Maino, Caroline Baker and Paige Blue. Their website describes them as: "Whip-smart and wildly irreverent, Nashville-based band Tramp Stamps are introducing a fantastically unfiltered new voice into today's pop landscape."

They have promoted themselves largely on the social media site TikTok, where they have gained nearly 400,000 followers. Their TikTok posts portray them as an independent, Do-It-Yourself (DIY) band, as illustrated by posts about their origin story, which they state as: "3 girls got drunk at a bar and wrote a song" (pictured below).

What is your familiarity with TRAMP STAMPS prior to reading this?
• I have listed to or purchased TRAMP STAMPS songs.

If you were interested in pop-punk music, how appealing do you think TRAMP STAMPS music would be? (1 = Not at all appealing, 9 = Very appealing)

On the whole do you think TRAMP STAMPS provides good experience for there listeners'?
(1= Not at all, 9 = Definitely)
(Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1 = Not likely at all, 9 = Very Likely)
• Listening to Tramp Stamps is fun.
• Listening to Tramp Stamps is entertaining.
• Tramp Stamps is a band that started from humble beginnings.
• Tramp Stamps earned their way to initial success.
• Tramp Stamps' origin story is genuine.
 (Note: last three items comprise rating of initial claim belief)

Now we would like to give you some more information about the band Tramp Stamps. Below is an excerpt from an article about them from slate.com.

From the Slate article: Is This Viral Band Really Who They Say They Are?

"The trio, a group of young women called Tramp Stamps, has more than 385,000 followers on TikTok and more than 27,000 Instagram followers, gaining fans on social media with only three songs out to date. But they've also attracted a lot of critics. The band has faced numerous allegations about whether their claims of being "indie" or "feminist punks" are legitimate—and whether they're just industry plants.

All three members had worked in the music industry prior to forming the band: Blue is a producer and songwriter whose music has appeared in advertising for brands like Apple and Sephora, along with movies and TV shows from networks like Disney and MTV. She has deals with major publishing house Downtown Music Publishing and its partner publishing company Pray for My Haters. Baker and Maino have released solo pop music in the past; Baker's debut EP came out in 2019, and her most recent solo EP came out in March of this year. Baker signed a publishing deal with Prescription Songs in 2019, and Maino also joined Prescription as a writer last year[...]TikTok user @hard_cope found that the band had a professional-looking webpage and a robust social media presence, and used animation in their posts—all quite advanced things for a supposedly DIY band to do on their own.

Despite this background, the members of Tramp Stamps pride themselves on the organic origin story they lay claim to. According to them, they're just three women coming together to make music—although even this has been called into question. "

Having read this information, please answer the following questions below.

Now, if you were interested in pop-punk music, how appealing do you think Tramp Stamps music would be? (1 = Not at all appealing, 9 = Very appealing)

Now, on the whole do you think Tramp Stamps provides good experience for their listeners? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise second rating of valuation of product)

How likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely).
• Listening to Tramp Stamps is fun.
• Listening to Tramps Stamps is entertaining.
• Tramp Stamps is a band that started from humble beginnings.
• Tramp Stamps earned their way to their initial success.
• Tramp Stamps' origin story is genuine.
(Note: preceding three items comprise second rating of claim belief)

• Listening to Tramp Stamps can help connect one to a desirable alternative lifestyle.
• Listening to Tramp Stamps can help one feel more authentic.
• Listening to Tramp Stamps can help one feel empowered.
(Note: preceding three items comprise rating of symbolic benefits)

Authenticity of bands is very important to some fans, and often bands get criticized for having misleading origin stories. Some wind up being accused of being "industry plants" that were created by already successful music industry professionals rather than organically. How do you feel about this? (1 = Strongly disagree, 9 = Strongly agree)

• It is silly to criticize bands for their origin stories.
• For listeners, it does not matter if a band is an "industry plant".
• People who criticize the authenticity of bands are being close-minded.
• People who criticize the authenticity of bands are missing the point.
• Debating how authentic a band is puts unfair limitations on bands' rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely)

• The writer of the story from on the previous page presented information about Tramp Stamps he or she knew was not true.
• The story from the previous page left out important information necessary to have an informed opinion about Tramp Stamps.

Below is some information about the pop-punk band Doll Skin, pictured below. According to their social media accounts, "Doll Skin is an American rock band from Phoenix, Arizona. The band is led by Meghan Herring and Sydney Dolezal. Their sound is a blend of punk, metal, alternative, and pop...Since 2013, the band have been making their mark in the alternative rock world with their energy, creativity, and grit. Their most recent release...has received rave reviews." The band formed when the members were still in high school, with some of the members playing their instruments since as young as age 13.

What is your familiarity with the band Doll Skin prior to reading this?
• I have listened to Doll Skin's music.
• I have heard of Doll Skin but have never listened to their music.
• I have never heard of Doll Skin.
 If you were interested in pop-punk music, how appealing do you think Doll Skin music would be? (1 = Not at all appealing, 9 = Very appealing)

On the whole do you think Doll Skin provides good experience for their listeners'? (1= Not at all, 9 = Definitely)
(Note: the two preceding items comprise initial rating of valuation of product) Based on what you currently know, how likely do you consider each of the following? (1 = Not likely at all, 9 = Very Likely)
• Listening to Doll Skin is fun.
• Listening to Doll Skin is entertaining.
• Doll Skin is a band that started from humble beginnings.
• Doll Skin earned their way to initial success.
• Doll Skin's origin story is genuine.
(Note: last three items comprise rating of initial claim belief)

Below is some additional information about the band Doll Skin, from an article on vice.com.

From the vice.com article: Doll Skin's Joyful Pop Punk Is the Future

"Judging by their ages—Sydney, the youngest, is 19, and Meghan, 22, is the oldest—one might be surprised to learn that Doll Skin has been a band for six years now. Sydney was "literally thirteen" when she, Meghan, and Alex started playing together in 2013 at the School of Rock after-school program in their hometown of Phoenix, AZ . [They] decided to compete in her school's Battle of the Bands, an annual amateur rock contest. With their covers of Dead Sara's "Weatherman" and Alanis Morisette's "Uninvited," along with the anthemic ode to rock concerts, "Family of Strangers," their first original song, they ended up taking first place. "Which is like, a big deal at that high school," Sydney notes. Megadeth bassist David Ellefson happened to be sitting in the audience, and shortly thereafter, he became Doll Skin's manager. In 2015, the band self-released In Your Face, a seven-track EP which they would reissue the following year after signing to Ellefson's label, EMP.

With their distinct individual personalities and enthusiastic openness, Doll Skin have made it easy to become invested in their story. It's one reason their fans—the Rat Pack —are so passionate. Doll Skin's just-released third full-length is another window into the lives of these young women as they grow into adulthood. "Each album is a little spot in time, representing—I'm serious!—what we were going through," Meghan says, referencing a lyric from the La Dispute song "Woman (In Mirror).

" Having read this information, please answer the following questions below.
Now, if you were interested in pop-punk music, how appealing do you think Doll Skin music would be? (1 = Not at all appealing, 9 = Very appealing)

Now, on the whole do you think Tramp Stamps provides good experience for their listeners? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise second rating of valuation of product)

 How likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely).
• Listening to Doll Skin is fun.
• Listening to Doll Skin is entertaining.
• Doll Skin is a band that started from humble beginnings.
• Doll Skin earned their way to their initial success.
• Doll Skin's origin story is genuine.
(Note: preceding three items comprise second rating of claim belief)

• Listening to Doll can help connect one to a desirable alternative lifestyle.
• Listening to Doll Skin can help one feel more authentic.
• Listening to Doll Skin can help one feel empowered.
(Note: preceding three items comprise rating of symbolic benefits)

Authenticity of bands is very important to some fans, and often bands get criticized for having misleading origin stories. Some wind up being accused of being "industry plants" that were created by already successful music industry professionals rather than organically. How do you feel about this? (1 = Strongly disagree, 9 = Strongly agree)

• It is silly to criticize bands for their origin stories.
• For listeners, it does not matter if a band is an "industry plant".
• People who criticize the authenticity of bands are being close-minded.
• People who criticize the authenticity of bands are missing the point.
• Debating how authentic a band is puts unfair limitations on bands' rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely)
• The writer of the story from on the previous page presented information about Doll Skin he or she knew was not true.
• The story from the previous page left out important information necessary to have an informed opinion about Doll Skin.

Study C. Medical Products

In this part of the study, we'd like to ask you for your views on Body Vibes wearable stickers, a product sold by the brand "goop". Below is a screenshot about the stickers from goop's website.

☆ RITUALS AND SPIRITUAL PRACTICES ▾

Wearable Stickers that Promote Healing (Really!)

What is your familiarity with goop prior to reading this?
• I have bought at least one goop product.
• I have heard of goop but never bought a product.
• I've never heard of goop before.
• Not sure.

What is your familiarity with Body Vibes wearable stickers prior to reading this?
• I have bought at least one Body Vibes wearable stickers product.
• I have heard of Body Vibes wearable stickers but never bought a product.
• I've never heard of Body Vibes wearable stickers before
• Not sure

If you were looking for a product to alleviate pain, how interested would you be in Body Vibes stickers? (1 = Not at all interested, 9 = Very interested)

On the whole do you think Body Vibes stickers provide good value for their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise initial rating of valuation of product)
Based on what you currently know, how likely do you consider each of the following?
• Body Vibes stickers provide the benefits described on the website.
• The claims on the website about Body Vibes stickers aiding physical health are accurate.
(Note: last two items comprise rating of initial claim belief)

Thank you!

We'd now like to give you a bit more information on the healing stickers sold by goop. Below is an excerpt from an businessinsider.com article on the controversy surrounding goop, specifically about whether the stickers actually deliver pain relief as advertised.

From the Business Insider article: Gwyneth Paltrow and Goop's latest health fad was so bad that NASA got involved.

A recent post on the site [of goop, the brand owned by Gwyneth Paltrow] introduces readers to a new product: "Stickers that promote healing."

The stickers, made by a company called Body Vibes, range in price from $60 (for a 10-pack) to $120 (for a 24-pack). They're targeted for different issues. There's one for your skin, one for hangovers, one for focus, one for endurance, one for anxiety. The stickers also claim to hydrate, detox, boost mood, improve sleep, and better your "self-love."

Goop says that the stresses of daily life can "throw off" our bodies' "ideal energetic frequency." The stickers, the site claims, can "rebalance the energy frequency in our bodies."

But Jen Gunter, MD — a doctor who frequently combats shady Goop advice — told INSIDER that the stickers are just as ridiculous as they sound.

"This term 'rebalance the energy frequency in our bodies' makes no sense medically," she said. "There is no medical way to measure energy frequency." Gunter also questioned how the stickers (supposedly made from "the same conductive carbon material NASA uses to line space suits") could possibly "come pre-programmed to an ideal frequency, allowing them to target imbalances," as Goop writes. "What does that even mean?" Gunter said. "How do you program a fabric?"

Gizmodo's Rae Paoletta actually contacted NASA to figure out whether the spacesuit claim was true. Unsurprisingly, a rep said that the NASA spacesuits "do not have any conductive carbon material."

Mark Shelhamer, former chief scientist at NASA's human research division, wasn't wooed by Body Vibes or its secret research. "Wow," he told Gizmodo. "What a load of BS this is."

Having read this information, please answer the questions below.

Now, if you were looking for a product to alleviate pain, how interested would you be in Body Vibes stickers? (1 = Not at all interested, 9 = Very interested)

Now, on the whole do you think Body Vibes stickers provide good value for their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise second rating of valuation of product)
Based on what you currently know, how likely do you consider each of the following?

• Body Vibes stickers provide the benefits described on the website.
• The claims on the website about Body Vibes stickers aiding physical health are accurate.
(Note: preceding two items comprise second rating of claim belief)

• The branding of Body Vibes stickers is fun.
• The branding of Body Vibes stickers is entertaining.
• Choosing Body Vibes stickers from goop would make you feel empowered.
• Choosing Body Vibes stickers from goop would make you feel in control of your health.
• Choosing Body Vibes stickers from goop would connect you to a more ideal lifestyle.
• Choosing Body Vibes stickers from goop would make you feel authentic.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with each of the following statements about health-related products like this. (1 = Strongly Disagree, 9 = Strongly Agree).

• It's silly to be concerned with the effectiveness of products like this.
• For users, it doesn't matter all that much whether products like this are actually effective.
• People criticizing the effectiveness of products like this are missing the point.
• People criticizing products like this are closed-minded.
• Checking the accuracy of claims about products like this puts unfair limitations on business rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following? (1 = Not at all, 9 = Very likely).
• The writer of the story on the previous page presented information about Body Vibes stickers he or she knew was not true.
• The story from the previous page left out important information.

Thank you. For this part of the survey, we would like to show you Hum Nutrition - Here Comes the Sun Potency Vitamin D3.

This product can also be found on the website and brand goop.com. Below is what Hum Nutrition claims about their Vitamin D3 product:

"Hum Nutrition loads this supplement with the same form of vitamin D3 that your body produces in response to sunlight. They've also reformulated it to be vegan; this supplement now contains D3 sourced from lichen instead of lanolin. You can take it daily to help support cellular health and strong bones."

What is your familiarity with goop prior to reading this?
• I have bought at least one goop product.
• I have heard of goop but never bought a product.
• I've never heard of goop before.
• Not sure.

What is your familiarity with Hum Nutrition Vitamin D3 supplements prior to reading this?
• I have bought at least one bottle of Hum Nutrition Vitamin D3 supplements.
• I have heard of Hum Nutrition Vitamin D3 supplements but never purchased any.
• I've never heard of Hum Nutrition Vitamin D3 supplements before.
• Not sure

If you were looking for a product to alleviate pain, how interested would you be in Hum Nutrition Vitamin D3 supplements? (1 = Not at all interested, 9 = Very interested).

On the whole do you think Hum Nutrition Vitamin D3 supplements provide good value for their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following?
• Hum Nutrition Vitamin D3 supplements provide the benefits described on the website.
• The claims on the website about Hum Nutrition Vitamin D3 supplements aiding physical health are accurate.
(Note: last two items comprise rating of initial claim belief)

Thank you. Now we would like to show you some more information about Vitamin D3 supplements.

The following information is excerpted from the National Institutes of Health Fact Sheet for Vitamin D dietary supplements:

Vitamin D (also referred to as "calciferol") is a fat-soluble vitamin that is naturally present in a few foods, added to others, and available as a dietary supplement. It is also produced endogenously when ultraviolet (UV) rays from sunlight strike the skin and trigger vitamin D synthesis. [...]

Vitamin D promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate concentrations to enable normal bone mineralization and to prevent hypocalcemic tetany (involuntary contraction of muscles, leading to cramps and spasms). It is also needed for bone growth and bone remodeling by osteoblasts and osteoclasts. Without sufficient vitamin D, bones can become thin, brittle, or misshapen. Vitamin D sufficiency prevents rickets in children and osteomalacia in adults. [...] Vitamin D has other roles in the body, including reduction of inflammation as well as modulation of such processes as cell growth, neuromuscular and immune function, and glucose metabolism.[...]

Serum concentration of 25(OH)D is currently the main indicator of vitamin D status. It reflects vitamin D produced endogenously and that obtained from foods and supplements[...] To maintain serum 25(OH)D levels above 75 nmol/L (30 ng/mL), adults might need at least 37.5 to 50 mcg (1,500–2,000 IU)/day of supplemental vitamin D.

Having read this information, please answer the following questions below.

Now, if you were looking for a product to alleviate pain, how interested would you be in Hum Nutrition Vitamin D3 supplements? (1 = Not at all interested, 9 = Very interested)

Now, on the whole do you think Hum Nutrition Vitamin D3 supplements provides a good value for their customers? (1 = Not at all, 9 = Definitely) (Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following?
• Hum Nutrition Vitamin D3 supplements provides the benefits described on the website.
• The claims on the website about Hum Nutrition Vitamin D3 supplements aiding physical health are accurate. (Note: preceding two items comprise second rating of claim belief)
• The branding of Hum Nutrition Vitamin D3 supplements is fun.
• The branding of Hum Nutrition Vitamin D3 supplements is entertaining.
• Choosing Hum Nutrition Vitamin D3 supplements from goop would make you feel empowered.
• Choosing Hum Nutrition Vitamin D3 supplements from goop would make you feel in control of your health.
• Choosing Hum Nutrition Vitamin D3 supplements rs from goop would connect you to a more ideal lifestyle.
• Choosing Hum Nutrition Vitamin D3 supplements from goop would make you feel authentic.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with each of the following statements about health-related products like this. (1 = Strongly Disagree, 9 = Strongly Agree).
• It's silly to be concerned with the effectiveness of products like this.
• For users, it doesn't matter all that much whether products like this are actually effective.
• People criticizing the effectiveness of products like this are missing the point.
• People criticizing products like this are closed-minded.
• Checking the accuracy of claims about products like this puts unfair limitations on business rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following? (1 = Not at all, 9 = Very likely).
• The writer of the story on the previous page presented information about Body Vibes stickers he or she knew was not true.
• The story from the previous page left out important information.

Study D. Animal Products Marketed as "Humane"

In this part of the study we'd like to ask you about your views on Sparboe Farms eggs. According to Sparboe Farms, they provide "quality shell eggs to families across America".
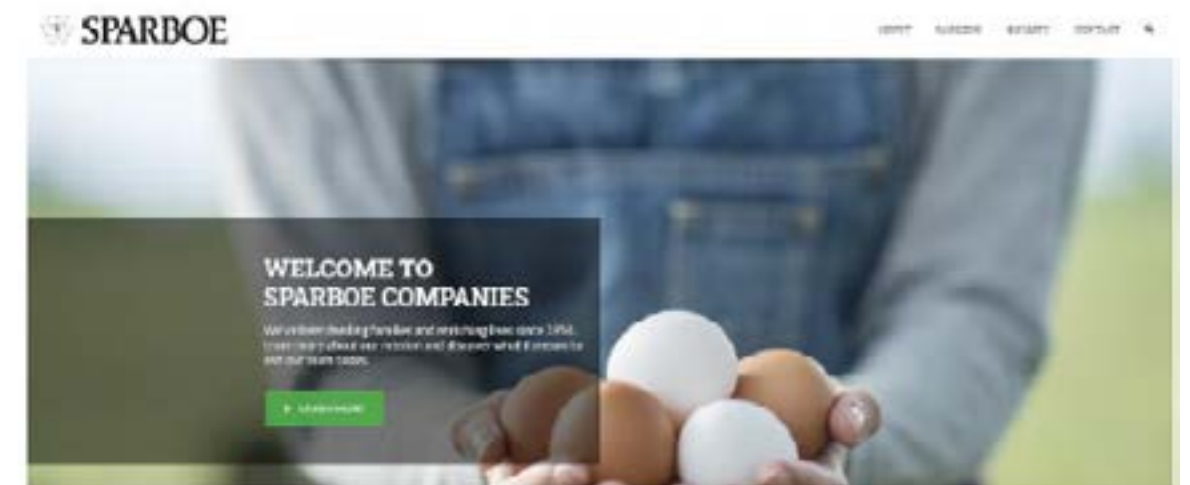
Their website features a "Food Safety and Quality Policy Statement", which reads "Sparboe Companies is committed to supplying safe and quality food by establishing, implementing and monitoring food safety/quality practices that meet customers' expectations and regulatory requirements. We strive for continuous improvement in our mission of feeding families ~ enriching lives."

They also feature an "Animal Code of Conduct", which states that the company's hens won't suffer from hunger, thirst or pain. It also says that Sparboe hens have "freedom to express normal behavior" and "freedom from fear and distress."

What is your familiarity with Sparboe eggs prior to reading this?
• I have bought at least one Sparboe Farms egg.
• I have heard of Sparboe Farms eggs but have never bought them.
• I have never heard of Sparboe Farms eggs.
• Not sure.
If you were looking to buy some eggs, how interested in Sparboe Fars eggs would you be? (1 = Not at all interested, 9 = Very Interested).

On a whole, do you think Sparboe Farms provides good value to their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely)

• Sparboe Farms eggs are nutritious.
• Sparboe Farms eggs taste good.
• Sparboe Farms eggs are safe to consume.
• Sparboe Farms eggs are obtained using humane practices.
• Sparboe Farms does not unnecessarily harm animals.
(Note: last two items comprise rating of initial claim belief)

Now we would like to give you a bit more information about Sparboe Farms eggs.
Below is an excerpt from an ABC News article on Sparboe Farms:

"A video first aired on ABC News shows animal abuse and unsanitary conditions at Sparboe Farms facilities in three states. Target and other retailers announced that they would stop buying eggs from Sparboe after learning the results of the ABC News investigation.

[...]Nathan Runkle of Mercy for Animals said that Sparboe is ignoring the bigger issue of keeping hens in so-called "barren" battery cages, which he says prevent the birds from engaging in basic animal behavior. "This isn't a case of a few rotten employees, this is a matter of Sparboe subjecting every hen in its care to a lifetime of intensive confinement and deprivation. Sparboe's true actions on animal care issues don't line up with their PR rhetoric."

Sparboe Schnell, whose company was started in 1954 by her late father, addressed an FDA warning letter sent to the company last week that detailed serious concerns after inspection of Sparboe facilities. "Our team will continue to work with the FDA to successfully address the remaining concerns"."

Having read this information, please answer the following questions below.
Now having read this information, how interested in Sparboe Fars eggs would you be? (1 = Not at all interested, 9 = Very Interested).

Now, on a whole, do you think Sparboe Farms provides good value to their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1 = Not at all likely, 9 = Very likely)

• Sparboe Farms eggs are nutritious.
• Sparboe Farms eggs taste good.
• Sparboe Farms eggs are safe to consume.
• Sparboe Farms eggs are obtained using humane practices.
• Sparboe Farms does not unnecessarily harm animals.

(Note: preceding two items comprise second rating of claim belief)

• The branding of Sparboe Farms is fun.
• The branding of Sparboe Farms is entertaining.
• Choosing Sparboe Farms eggs would make you feel empowered.
• Choosing Sparboe Farms eggs would make you feel authentic.
• Choosing Sparboe Farms would connect you to a more ideal lifestyle.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with the following statements about "humane" products or products that emphasize animal welfare. (1 = Strongly disagree, 9 = Strongly agree)

• It is silly to be concerned with whether claims about how humane a product is.
• For customers, it does not matter all that much whether claims about how humane a product is are true.
• People criticizing claims about products being humane are close-minded.
• People criticizing claims about products being humane are missing the point.
• Checking the accuracy of claims about products being humane puts unfair limitations on business's rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following?

• The writer of the story from on the previous page presented information about Sparboe Farms he or she knew was not true.
• The story from the previous page left out important information.

Thank you. For this Part of the survey, we would like to show you some information about La Querica meat products. Below is an excerpt and photo by La Quercia from their website:

"Better meat makes better cured meat, and better meat relies on humane husbandry.

Over the last decade+ of our business, we have worked to support the kinds of farm systems and animal husbandry practices that we believe in. This has meant working closely with the farmers who raise the pigs we buy to develop standards and protocols for the animals in their care.

We are proud to purchase a majority of our pork from farmers whose husbandry has been third party audited by the Global Animal Partnership (GAP) 5 Step Program. 75% of the pork we currently purchase has been certified by GAP and 53% has been rated Step 3 (Pasture Assisted) or higher."
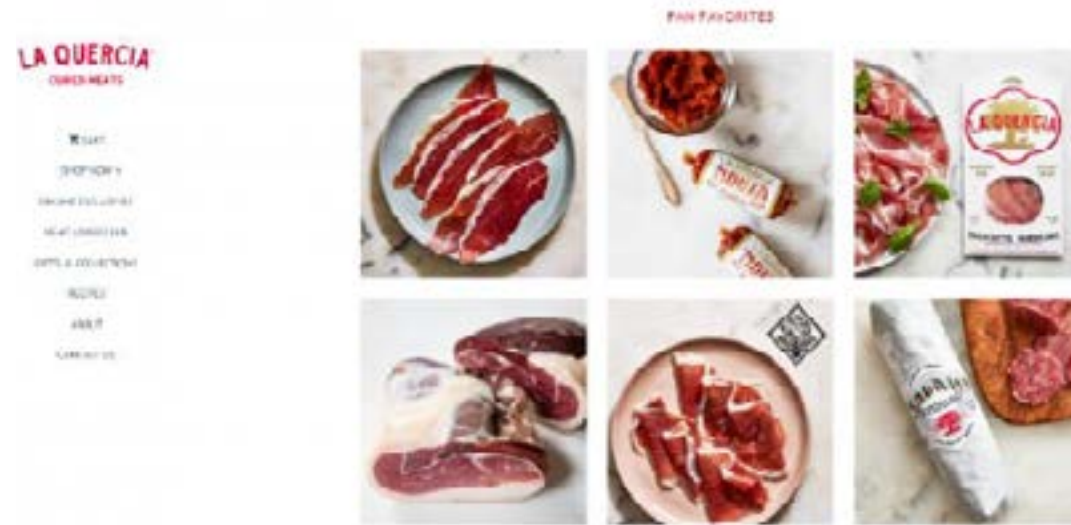
What is your familiarity with La Quercia prior to reading this?
• I have purchased at least one La Quercia product before.
• I have heard of La Quercia before but have never purchased from them.
• I have never heard of La Quercia before.
• Not sure.

If you were looking to buy pork products, how interested in La Quercia products would you be? (1 = Not at all interested, 9 = Very interested).
On the whole, do you think that La Quercia meat products provides a good value for their customers. (1 = Not at all, 9 = Definitely) (Note: the two preceding items comprise initial rating of valuation of product)
Based on what you currently know, how likely do you consider each of the following?
• La Quercia meats are nutritious.
• La Quercia meats taste good.
• La Quercia meats are safe to consume.
• La Quercia meats are obtained using humane practices.
• La Quercia does not unnecessarily harm animals. (Note: last two items comprise rating of initial claim belief) Now we would like to give you some more information about La Quercia products.

The Global Animal Partnership (G.A.P.) is a non-profit organization that rates the welfare status of farmed animal products. La Quercia has a level 4 G.A.P certification meaning it is labeled as Animal Welfare Certified. Below is more information about G.A.P. from their website explaining their certification: "G.A.P. uses independent, third-party certifiers to audit farms and verify compliance to our comprehensive standards and to assign the appropriate animal welfare certification level. G.A.P requires farms, raw material manufacturers, processing facilities, packaged product manufacturers, retailers, and foodservice establishments to abide by defined chain of custody protocols to ensure that all G.A.P. certified meat products are labeled and segregated properly before they are available for purchase." Below are the requirements the G.A.P lists to be certified at their fourth level, the second highest level as they define animal welfare.

After reading this, please answer the questions below.
Now, if you were looking to buy pork products, how interested in La Quercia products would you be? (1 = Not at all interested, 9 = Very interested).

Now, on the whole, do you think that La Quercia meat products provides a good value for their customers. (1 = Not at all, 9 = Definitely)
(Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following? (1= Not at all Likely, 9 = Very Likely).
• La Quercia meats are nutritious.
• La Quercia meats taste good.
• La Quercia meats are safe to consume.
• La Quercia meats are obtained using humane practices.
• La Quercia does not unnecessarily harm animals.

(Note: preceding two items comprise second rating of claim belief)
• La Quercia's branding is fun.
• La Quercia's branding is entertaining.
• Choosing La Quercia meats would make you feel empowered.
• Choosing La Quercia meats would make you feel more authentic.
• Choosing La Quercia meats would connect you to a more ideal lifestyle.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with the following statements about "humane" products or products that emphasize animal welfare.

• It is silly to be concerned with whether claims about how humane a product is.
• For customers, it does not matter all that much whether claims about how humane a product is are true.
• People criticizing claims about products being humane are close-minded.
• People criticizing claims about products being humane are missing the point.
• Checking the accuracy of claims about products being humane puts unfair limitations on business's rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following?
• The writer of the information from G.A.P presented on the previous page presented information about La Quercia he or she knew was not true.
• The G.A.P. report left out important information.

Study E. Products marketed as "sustainable" or "environmentally friendly."

For this part of the study, we would like to ask you on your views on Mrs. Meyer's cleaning products.

Below is an excerpt from Bed Bath and Beyond and a piece of advertisement from Mrs. Meyer's, with their dish soap pictured:

"Inspired by an Iowa homemaker and mother of nine, Mrs. Meyer's® is part of the Minnesota-based Caldrea family of brands. Caldrea was founded on a simple principle - that our homes should be a beautiful experience. Believing there is a better way to get clean, Mrs. Meyer's® Clean Day products are earth-friendly household cleaners made of plant-derived ingredients and essential oils; they are an effective alternative for people who are concerned about the environmental effects of conventional household cleaning products. The range of products includes aromatherapeutic lavender cleaning products, lemon verbena cleaning products, geranium cleaning products, laundry cleaning products and more; specific items include all-purpose cleaner, liquid dish soap, liquid hand soap, countertop spray, fabric softener, dryer sheets and more. The essential oils have naturally occurring, hard-working yet gentle cleaning agents which also provide a singular, special fragrance for your entire home.

What is your familiarity with Mrs. Meyer's cleaning products prior to reading this?
• I have purchased and used at least one Mrs. Meyer's product
• I have heard of Mrs. Meyer's products but have never used any.
• I have never heard of Mrs. Meyer's products
• Not sure

If you were searching for dish soap, how interested in Mrs. Meyer's dish soap would you be? (1 = Not at all interested, 0 = Very Interested).

On the whole, do you think that Mrs. Meyer's dish soap provides a good experience for their customers? (1= Not at all
Based on what you currently know, how likely do you consider each of the following (1 = Not at all likely)
(Note: the two preceding items comprise initial rating of valuation of product)

• Mrs. Meyer's dish soap cleans effectively.
• Mrs. Meyer's dish soap has a pleasant odor.
• Mrs. Meyer's dish soap is practical to use.
• Mrs. Meyer's dish soap is created using sustainable practices.
• Mrs. Meyer's dish soap does NOT harm the environment. (Note: last two items comprise rating of initial claim belief)

Thank you!

Now we would like to give you a bit more information on Mrs. Meyer's cleaning products.

Excerpted from the vox.com article "How Mrs. Meyer's took over the hand soap aisle":

"Whether it's intentionally vague language ("chemical-free") or straight-up obfuscation about ingredients, greenwashing [when brands inaccurately claim their products help or are safe for the environment] has crept into many products sold by major retailers. [Mrs. Meyer's] has gotten pushback due to synthetic ingredients like methylisothiazolinone, a possible allergy trigger that could also present a hazard to aquatic life."

This article also referred to rankings from the non-profit Environmental Working Group (EWG). The EWG ranked its products based on how safe their ingredients are, with most Mrs. Meyers' products (including their dish soap) scoring a "D".
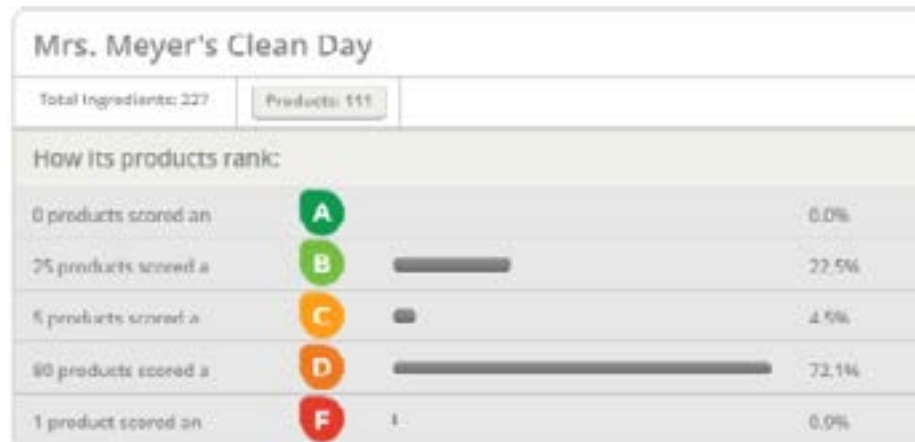
Having read this information, please answer the following questions below.

Now if you were searching for dish soap, how interested in Mrs. Meyer's dish soap would you be? (1 = Not at all interested, 0 = Very Interested).

Now, on the whole, do you think that Mrs. Meyer's dish soap provides a good experience for their customers? (1 = Not at all, 9 = Definitely)

(Note: the two preceding items comprise second rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following (1 = Not at all likely)

• Mrs. Meyer's dish soap cleans effectively.
• Mrs. Meyer's dish soap has a pleasant odor.
• Mrs. Meyer's dish soap is practical to use.
• Mrs. Meyer's dish soap is created using sustainable practices.
• Mrs. Meyer's dish soap does NOT harm the environment.
• (Note: preceding two items comprise second rating of claim belief)

• The branding of Mrs. Meyer's is fun.
• The branding of Mrs. Meyer's is entertaining.
• Choosing Mrs. Meyer's products would make you feel empowered.
• Choosing Mrs. Meyer's products would make you feel authentic.
• Choosing Mrs. Meyer's products would connect you to a more ideal lifestyle.

(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with the following statements about "environmentally-friendly" or "sustainable" products. (1 = Strongly Disagree, 9 = Strongly Agree)

• It's silly to be concerned with whether claims about how environmentally friendly or sustainable a product is true.
• For customers, it doesn't matter all that much whether claims about how environmentally friendly or sustainable a product is true.
• People criticizing claims about products being environmentally-friendly or sustainable are close-minded.
• People criticizing claims about products being environmentally-friendly or sustainable are missing the point.
• Checking the accuracy of claims about products being environmentally-friendly or sustainable puts unfair limitations on businesses' rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following?
• The writer of the story on the previous page presented information about Mrs. Meyers products he or she knew was not true.
• The story from the previous page left out important information. For this part of the survey, we will show you information about Humankind bar shampoos, a beauty brand that markets itself as sustainable. Below is an image of one of their products from the Humankind website:

Humankind lists the following "sustainability" benefits on its website:

"No single-use plastic — Our shampoo bar is 100% plastic-free, saving 2.45oz of single-use plastic waste with each bar."

When it's empty — Each bar is shipped in a recycled paper box with soy-based ink. This can be recycled with your other paper materials.

Carbon neutral — We offset 100% of our carbon footprint (including your order) by investing in strategic forest preservation projects."

What is your familiarity with Humankind shampoo bars prior to reading this?
• I have purchased at least one Humankind shampoo bar.
• I have heard of Humankind shampoo bars but have never purchased any.
• I have never heard of Humankind shampoo bars.
• Not sure. If you were looking to buy shampoo, how interested in Humankind shampoo bars would you be? (1 = Not at all interested, 9 = Very Interested)
On the whole, do you think that Humankind shampoos provide a good experience for their customers? (1 = Not at all, 9 = Definitely).
(Note: the two preceding items comprise initial rating of valuation of product)

Based on what you currently know, how likely do you consider each of the following (1 = Not at all, 9 = Very Likely).
• Humankind shampoos clean effectively.
• Humankind shampoos have a pleasant odor.
• Humankind shampoos are practical to use.
• Humankind shampoos products are created using sustainable practices.
• Humankind shampoo products do NOT harm the environment.
(Note: last two items comprise rating of initial claim belief)

Now we would like to give you some more information about Humankind shampoo bars.

Humankind shampoo bars were purchased, tested, and reviewed on the website "Reviewed.com" in 2020. Below is an excerpt from this article:

"Orders ship in 100 percent recycled materials and are carbon-neutral. That means that by Humankind sources responsibly and offsets the environmental impact of shipping by investing in strategic forest projects that balance the impact of its business.

After your first purchase, you'll have all the containers you'll need; then you can subscribe to the products you want, and it'll send "Kindfills" (refills) to match your usage (every eight weeks for deodorant and 12 weeks for body wash, for example). In short, you never run out of deodorant, shampoo, conditioner, body wash, or any other favorites. The goal in supplying just refills instead of the whole product is to help you reduce how much single-use plastic you buy and throw out...If being environmentally friendly and conscious of your personal impact is important to you, then by Humankind is a great fit...I was thrilled to see the mailed package and individual boxes breakdown in my compost bin, and putting the

refills to use gets rid of any storage problems you may have with clunky backup products. There's no need to stock multiple shampoos or deodorants when you can order a refill and use the same outer container."

Now if you were looking for a shampoo to purchase, how interested in Humankind shampoo bars would you be? (1 = Not interested at all, 9 = Very Interested).

Now on the whole, do you think that Humankind shampoos provide a good experience for their customers? (Not at all, 9 = Definitely). (Note: the two preceding items comprise second rating of valuation of product)

How likely do you consider each of the following (1 = Not at all likely, 9 = Very Likely)
• Humankind shampoos clean effectively.
• Humankind shampoos have a pleasant odor.
• Humankind shampoos are practical to use.
• Humankind shampoos products are created using sustainable practices.
• Humankind shampoo products do NOT harm the environment.
(Note: preceding two items comprise second rating of claim belief)

• The branding of Humankind shampoos is fun.
• The branding of Humankind shampoos is entertaining.
• Choosing Humankind shampoos would make you feel empowered.
• Choosing Humankind shampoos would make you feel authentic.
(Note: preceding three items comprise rating of symbolic benefits)

Please rate your agreement with eh following statements about "environmentally-friendly" or "sustainable" products.
• It's silly to be concerned with whether claims about how environmentally friendly or sustainable a product is true.
• For customers, it doesn't matter all that much whether claims about how environmentally friendly or sustainable a product is true.
• People criticizing claims about products being environmentally-friendly or sustainable are close-minded.
• People criticizing claims about products being environmentally-friendly or sustainable are missing the point.
• Checking the accuracy of claims about products being environmentally-friendly or sustainable puts unfair limitations on businesses' rights to put out whatever products they want.
(Note: preceding five items comprise rating of unfairness of accuracy check)

How likely do you consider each of the following? (1= Not at all likely, 9 = Very likely)
• The writer of the article on the previous page presented information about Humankind products he or she knew was not true.
The article from the previous page left out important information.

Miller
Matthew

Can China and the United States coexist or is conflict inevitable?

Abstract

Currently, China and the United States have increasing tensions with each other. The United States has the world's most powerful military, although recently China has been trying to close the gap between both countries' military spending. China has also been increasing the size of its navy, so that they can be more of a threat. For example, China has made claims in the South China Sea that the US and the rest of the international community do not support. However, since china has a formidable military, the international community has not reacted on a large scale. Furthermore, the Chinese are also emerging as a major economic power- they have the second highest GPD in the world, behind the United States and might surpass us in the near future. They could potentially use their massive economy to gain new allies and possibly turn the United States' allies against it. Should the United States view China's rise as a threat or accept it? If the United States were to accept the rise of China as a rival superpower, it would heighten the chances of there being a military conflict between the United States and China's powerful militaries.

Acknowledgement

Introduction

As the years have gone by, China has been growing more powerful. In record time, China has become one of the world's top economic powers and is steadily increasing in its goals of military modernization. It sets its sights on becoming an equal to that of the United States. It is also possible that the Chinese will surpass the United States and become the number one superpower in the world, dethroning the United States from its position that it has held for decades. In response to China's rise, the United States has two options. One option is to respond to the rise of China by viewing it as a threat and finding ways to impede on its growth. The second possible course of action is to accept that China is an equal power and work with them to find ways to coexist in a bipolar world.

If the United States were to not accept China as a rival superpower and find ways to impede on its growth, it would not end well. In recent years, China has been rapidly expanding its military modernization as well as rapid economic growth. An example of China's economic growth posing a problem to the United States is when during the opening stages of the coronavirus pandemic in the United States, the United States relied heavily on China for the

production of personal protective equipment (PPE) "According to official Chinese customs data released on March 25, Chinese exports of PPE to the world declined by only 15 percent in the first two months of 2020, relative to the same period in 2019 (figure 2). Notable is that China's exports of these medical products declined less than the rest of its exports to the world, which fell by 17 percent during the same period (PIIE)." In response, the United States was forced to produce its own which led to a large number of deaths among American citizens and medical personnel as they did not have the proper medical equipment to protect themselves from contracting COVID-19.

Figure 1

Much of the world's imports of personal protective equipment come from China
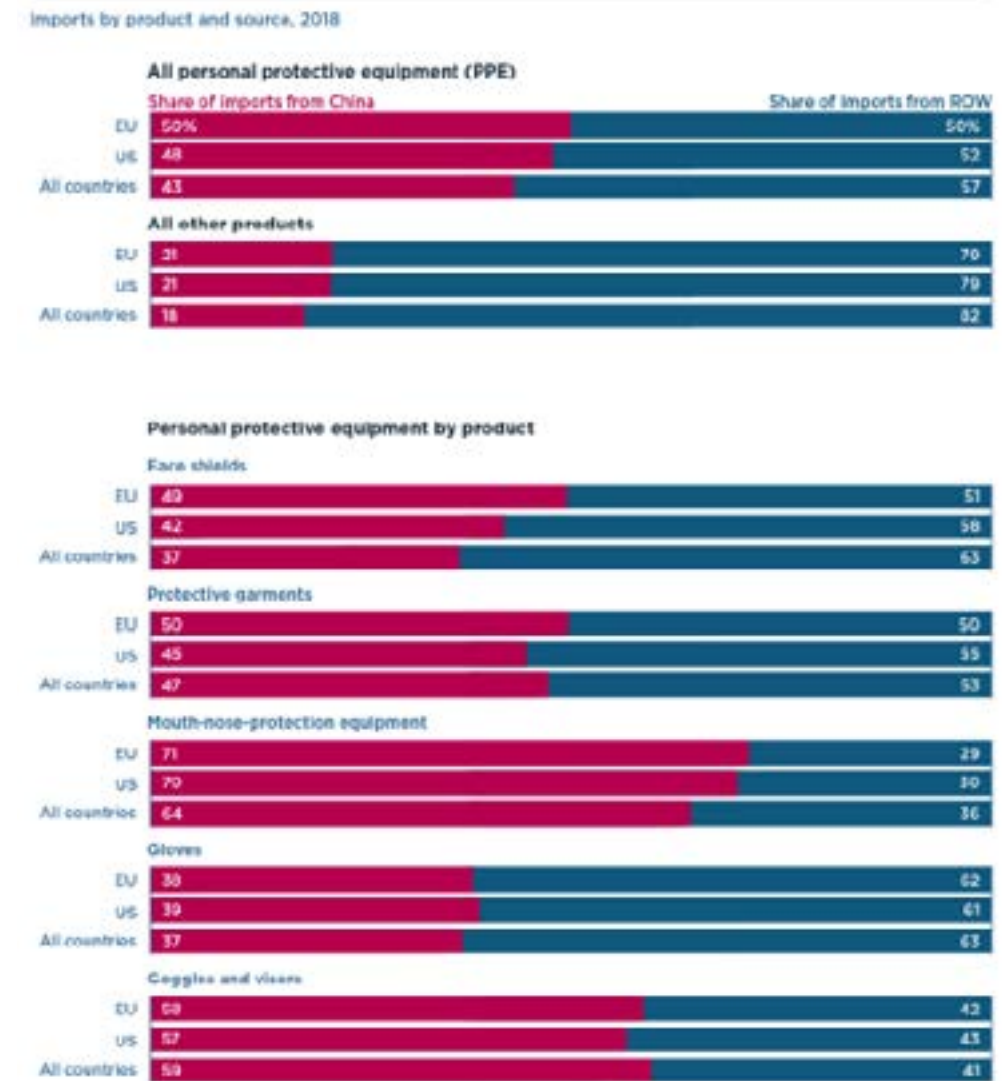
The economic competition between the United States and China can explain the current tensions between the two superpowers. According to the Financial Times, "provoked by China's covert military expansion into the South China Sea, and its expansive Belt and Road Initiative, as well as an ambitious plan to move up the value chain outlined in 2015- the relationship between the rising nation and the incumbent superpower more competitive (Colback)."

Progress of China's Growth:
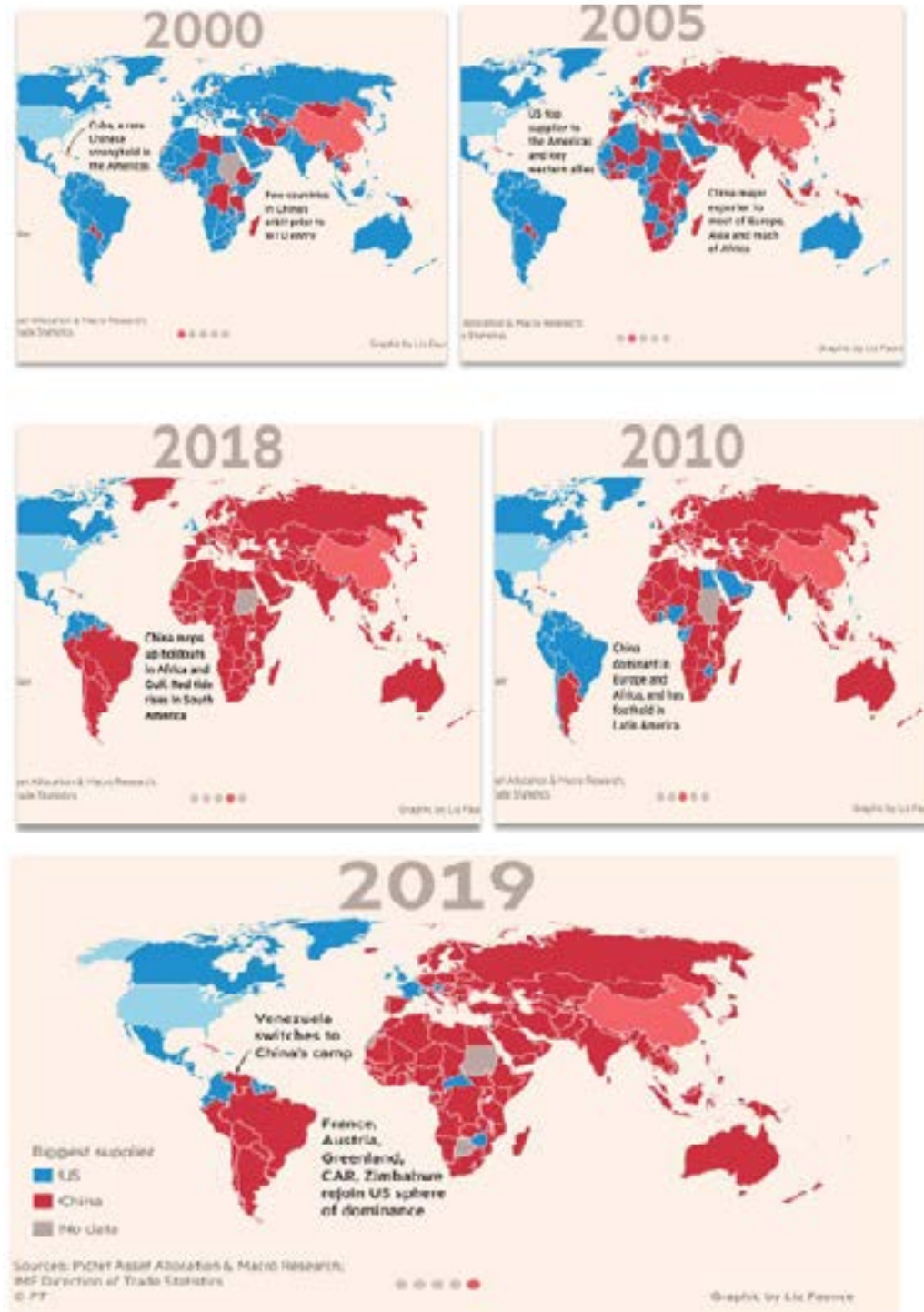
As the competition between the United States and China continues to increase, both countries are seeking to outdo the other in the tech industry. The United States is the current leader in chip production which is beneficial to the United States military for the production of weapons and other tools, but the Chinese do not want the United States to have backdoor access to their goods. In response, the Chinese have sought to outpace the United States in the tech sector. The United States does not want the Chinese to have the upper hand in the tech sector for the same reasons that the Chinese do not want the US to have the upper hand: national security concerns. According to the Financial times, "makers of technology products in the US and China are increasingly barred from using each other's products on 'national security' grounds. China plans to rip foreign technology out of state offices by 2023." In response to this, the United States banned Chinese tech suppliers like Huawei from selling certain products in the country. This has led to some scholars believing that the United States and China have begun to decouple their economies from each other.
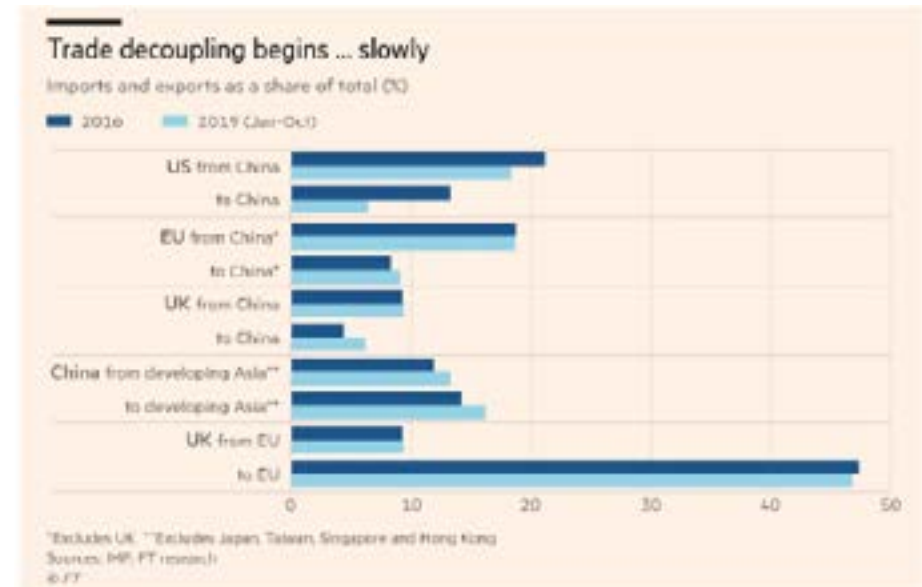
According to the Financial Times, it has steadily increased as time has progressed. This has led to some scholars feeling that conflict could happen some time in the future as countries that engage in trade with each other heavily are more likely to engage in conflict with each other.

An example of China's military modernization causing a problem is how as the years have gone by, China has increased its military modernization. Along with increasing military modernization, China has also been building ships to build a large naval force. They also are making strategies to keep the US navy at bay in a potential conflict. In a study by Stephen J Cimbala, "Along with [new and modern ballistic missile submarines], China's fleet of nuclear-powered attack submarines supports an ambitious anti-access/area denial (A2/AD) strategy to deter US military intervention to support allied interests in Asia against Chinese wishes." This strategy would allow them to hold onto contested territory and keep the United States from challenging their claims.

Military Expenditures by UNSC Country: SIPRI 1990-2015
(Current $US Billions)

	1990	1995	2000	2005	2010	2015
China	10.0	12.6	22.9	45.7	115.7	214.8
USA	306.2	278.9	301.7	503.4	698.2	596
UK	38.9	34.2	35.3	55.2	58	55.5
France	42.6	47.8	33.8	52.9	61.8	50.8
Russia	239.1	12.7	9.23	27.3	58.7	66.4

— China — USA — UK — France — Russia
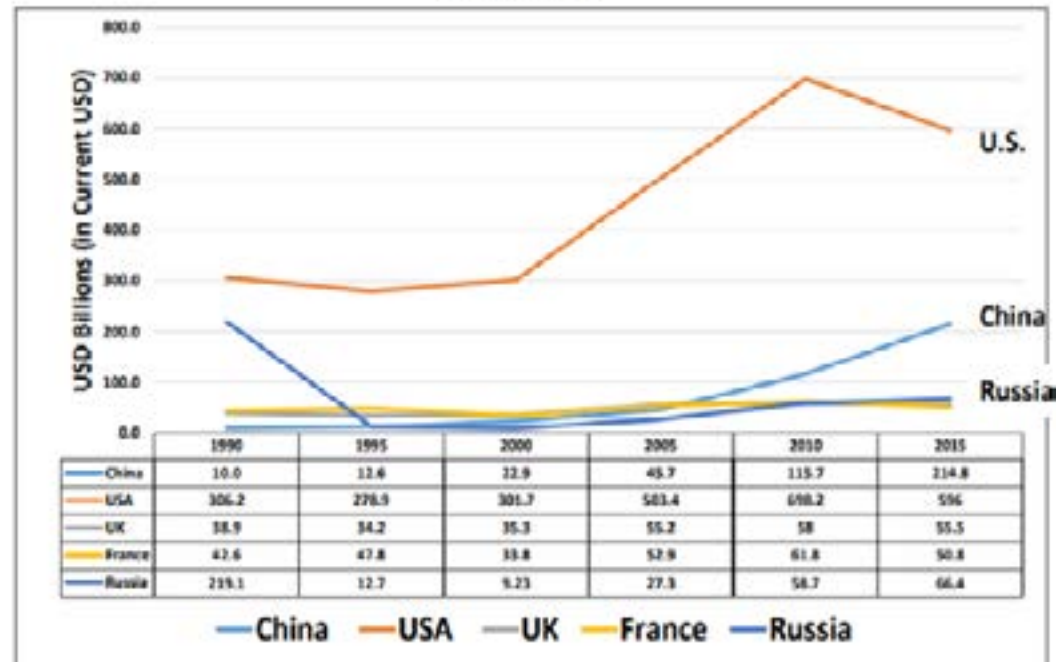
The Chinese military as it has perfected the modernization of its ground, air, and naval forces is beginning to perfect expanding its power beyond its coast and is in the beginning phases of sending their military throughout the world, maintaining their claims beyond its shores. According to the US-China Economic and Security Review Commission, "China's power projection capabilities are developing at a brisk and consistent pace, reflecting the civilian leadership's determination to transform the PLA into a global expeditionary force in a matter of decades (US-China Economic and Security Review Commission)." When China achieves military modernization equal to that of the United States, it will be able to send its military throughout the world just like the United States does. China will essentially be that of an equal to the United States which was a long-term goal sought by Chinese leadership. The Chinese seek a military that can expand far beyond its shores because it wants to resolve territorial disputes it has with its neighbors. "The first and most urgent of Beijing's strategic requirements involving the need for power projection capabilities is the requirement to resolve outstanding territorial disputes in its favor. Since the [Nationalists] fled the Mainland for Taiwan in 1949, the CCP has viewed the island's government as a direct challenge to the legitimacy of its claim to rule all of China (US-China Economic and Security Review Commission)." If China wants to be respected as a world class power, it will need to maintain its sovereignty and solidify the claims that it has. That would mean the seizure of territory that it claims in the South China Sea and also island territory that it disputes with Japan. It also unfortunately means the reunification of Taiwan whether it be through peaceful means or a military invasion and capture by the Chinese military. With record military modernization occurring in the Chinese armed forces, it is possible for the Chinese to do this, but the only thing that keeps China from invading Taiwan is the support that Taiwan has from the United States. To counter this, China has perfected the area access area denial tactic to make a possible intervention of the United States into a conflict between the United States and China more costly for the United States.

The Chinese seek to maintain fortified positions on various island chains to delay a hypothetical military intervention force sent by the United States to defend Taiwan. By delaying the United States from coming to Taiwan's aid, the Chinese would be able to occupy the island and the United States would be forced to decide on whether it should retake the island by force or acknowledge the Chinese victory. If the United States were to fail at preventing the fall of Taiwan at the hands of China, its image would be tarnished as allies throughout the would be unsure if the United States would be able to defend them.

Figure 1: First and Second Island Chains

Source: Created for the U.S.-China Economic and Security Review Commission; adapted from U.S. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2012*, May 2012, 40.

Figure 2: PLA Power Projection in East Asia and the South China Sea

Note: Port calls, bilateral exercises, and highlevel contacts between militaries included in the map are from 2010-2020. Only the countries and territories in the darker shade are analyzed for the purposes of this map.
Source: Created for the US-China Economic and Security Review Commission. Various.[47]

China also seeks to maintain military forces beyond its borders. This is to maintain its investments throughout the world as well as hold up its commitments to the United States security council. "China is already capable of executing a range of small-scale military operations that enable power projection far beyond its borders. According to Admiral Blair, today's PLA can conduct humanitarian response and peacekeeping operations; symbolic shows of force, political intervention, and coercive threats; and the protection of trade (US-China Economic and Security Review Commission)." When China sends its military abroad, it gives them valuable experience that their military can use for future military expeditions. In the future, they will be able to match the logistical capacity that the United States has so that they would be able to sustain themselves when they travel abroad to maintain the peace in war torn areas when China sends their troops on peacekeeping missions as well as maintaining their investments by providing security for them. The United States and China are also in an intense competition on a global scale when it comes to geopolitics. Both countries seek to mold the world into their own image in which they are at the top. The United States is the leader of the current world order after the fall of the Soviet Union. As China becomes powerful, the United States will once again have another competitor on a global scale. This is because, "the pervasive perception of the United States withdrawing from various global, institutional, and legal commitments under President Trump, combined with China's increased activism on the world stage under President Xi Jinping, has fueled the narrative that a geostrategic power shift is under way (Shambaugh). Under the past administration, there was an ununified response to the rise of China that some scholars feel led to the United States in China's eyes as weak.

They view this sign of weakness as an opportunity to expand their influence worldwide while the United States is gathering itself for a proper response under the next administration. Due to the previous administration's shortcomings with allies in South Asia, they have begun to look towards China to do business. "Even the United States' two long-standing allies, Thailand and the Philippines, have swung toward China—both contributing to, and resulting from, strained relations with Washington (Shambaugh)." When the United States does not meet the expectations that its allies have for it, they look to other powers to meet their needs. This is where the United States has been coming up short in their competition against China on the geopolitical stage.

It is important for the United States to maintain its relationship with Southeast Asia due to the importance the region to both the United States and China. The Strait of Malacca which runs through the region is where a large chunk of the world's trade goes through. "The Strait, which runs between Malaysia, Indonesia, and Singapore, is one of the busiest shipping lanes and trade routes in the world, with approximately 50,000 vessels ferrying 40 percent of the world's merchandise trade and 25 percent of all oil shipments carried by sea annually (Shambaugh)." If the United States lost this region to Chinese influence, it could potentially miss out on lots of trading opportunities in the region. The United States will be hard pressed to maintain its relationship that it currently has with Southeast Asian nations to prevent them from looking to do business with China.

A combination of China's economic, military, and geopolitical achievements will put the United States at a massive disadvantage when it comes to confronting the Chinese. China's growth is also being impeded by the United States support of Taiwan, which China views as a renegade province that it wants to reunify with whether it be through peaceful means or military conquest. If the United States reversed course on their decisions to impede on China's growth, it would have benefits for them both. China is a major exporting country, and the United States consumes a lot of products. Trade between the two countries for the past couple decades has been beneficial to them both. A good relationship between the United States and China would also be beneficial to the rest of the international community as their relationship also affects the world's economy. A tense relationship between the two would only worsen the economy.

This thesis will begin by introducing the research question. By introducing the research question, the paper covers the significance and importance of the tensions brewing the United States and China and how their relationship with each other is rapidly changing as China is starting to assert itself on the international stage and is becoming a competitor to the United States. After the introduction of the research question comes the main argument of the thesis. The question and argument are both supported by a literature review that covers different viewpoints of international relations that describe in that view what could happen with the relationship between the United States and China. Those viewpoints of international relations are realism, liberalism, constructivism, democratic peace theory, capitalist peace theory, authoritarian instability, and the economic ramifications that could happen if the decoupling between the United States and China were to continue. This thesis also goes into the possible outcomes if the United States were to not accept China as a rival power. The different bodies of literature cover different perspectives, but they all inform the hypothesis in this study. After this examination, the

hypothesis will be formally presented and later tested in a case study analysis. The basis of the thesis is a case study of whether the United States should attempt to coexist with China as a rival superpower. The results of the case study were that if the United States were to reject any attempts at finding a solution to its grievances with China, their economic relationship would be ruined. It would be in the United States best interest to preserve its economic relationship with China. If the United States went with this course of action, then a potential war between China and the United States would be averted.

Research Question

The question in my thesis is: How can the United States respond to the rise of China and the two countries coexist with each other or is conflict inevitable? My thesis explores the possible ramifications if the United States were to not accept China as a rival superpower and instead find ways to work against it as well as the reasons why the United States should find ways to coexist with China considering the economic relationship that they have with China. They should instead use diplomacy to find ways to ease the current tensions between the two so that they can have a better relationship and trade can continue. I will examine various sources describing the relationship the United States has with China as well as various points of contention that they have and possible courses of action that the United States can take in its standoff with the Chinese.

This question is extremely important not only to political scientists, but also to the American public and the international community. It is in the best interest of the world for the United States and China to have a good relationship with each other. When the United States and China have a good economic relationship, the world's economy benefits from it. If the United States were seeking to impede on China's growth, it could seek to turn its allies against it by encouraging them to decouple their economies from it as well as seeking for their help in keeping China's military expansions at bay by lending some of their troops to aid the United States in their efforts to keep China boxed in to prevent their rise in influence among their neighbors that have relationships with the United States. As tensions with China increase over their growing international influence, the United States views this as an encroachment on their global influence. This is an era of strategic competition and both the United States and China should seek ways to make sure that cooler heads will prevail to avert any miscalculations that could lead into conflict.

Argument

As previously stated, the research question that this thesis poses is "How can the United States respond to the rise of China and the two countries coexist with each other or is conflict inevitable?" The main argument proposed in this thesis is that the United States should seek ways that it can coexist with China as if it were to engage in a conflict with them instead, it would lead to war which would not be in their best interests. The reasoning for this rise in tension can be blamed on the United States feeling that it could lose influence around the world that it has had for decades due to its place at the top of the world after the fall of the Soviet Union. Specifically, this thesis analyzes the situation through different perspectives of international relations and determines what possible courses of actions the United States could take in their response to China's growing power.

Literature Review

Research question: How can the United States respond to the rise of China and the two countries coexist with each other or is conflict inevitable?
Why there could be tensions between the United States and China over China's rise:
The rise of China as a rival superpower to the United States is viewed as a problem that could have consequences. In this literature review, I will be discussing the theories of IR (realism, liberalism, and constructivism) and comparative politics (e.g., democratic peace, capitalist peace, and authoritarian instability) and the economic ramifications that can arise due to China's rise.

I. Realism

The realist approach to the current tensions between the United States and China describes it as a standoff between the two countries economically, militarily, and diplomatically. "Diplomatic and commercial engagement have not brought political and economic openness. Neither U.S. military power nor regional balancing has stopped Beijing from seeking to displace core components of the U.S.-led system (Campbell)." Realists might say that these current tensions between the US led system and China is happening because they view each other as an obstacle in achieving their national interests. One of China's interests is putting an official end to the Chinese civil war by reuniting with Taiwan whether by diplomatic means or military force. In recent years thanks to its rapidly growing economy, China has been rapidly modernizing its armed forces. As its forces become bigger and more modernized, there has been some concerns made by countries in the South China Sea. "As a case in point, however controversial and destabilizing, China's vast claims over islands and features in the South and East China Seas predate its current "rise" by decades (Liff)." A realist might think that China's rising military power is a direct threat to the US's presence in the Asia-Pacific region. China also poses a threat to the tiny nation of Taiwan. The US has been preventing this from happening for decades. Security ties between Taiwan and the United States is a thorn in China's side and impedes on their growth. One major issue China has in particular are the US weapons sales to Taiwan. This has long been a source of tension in the US-China relationship. Tensions between China and the United states could have devastating effects that could be felt worldwide if there was a conflict between them. This can be seen as China is making internal changes. China is restructuring its military so that it poses more of a threat to the United States in the regions closest to its borders. "China is on the path to create 420 ships by 2035 and outpace the United States as the world's biggest navy (Cordesman)." Realists would say that the reasoning behind China's rapid militarization can be viewed as China building up its forces so that it can assert itself in the face of US pressure. Some realists also believe that tensions between China and the US could possibly decrease in the future. "Some realists argue that the nuclear revolution and geography make territorial conquest more difficult in contemporary East Asia than it was in Europe in the nineteenth century and the first half of the twentieth century (Christensen)." The deterrents that China and the United States have for each other could prevent a conflict from starting. The possibility of a war starting would be slimmer as both countries are rational actors that would not prefer to get into a conflict that would cause widespread bloodshed. Other issues between the United States and China are the conflicts that are occurring in cyberspace. US officials want to work

closely with their Chinese counterparts on having a mutual understanding of each other in cyberspace. Efforts to do so have been complicated in recent years, however. "As China cyber specialist Amy Chang argued, 'the two nations continue to face substantial obstacles in developing cooperative efforts and improving mutual understanding" on the issue of cyberspace, to the point that "relations have devolved to near-complete distrust of each other's motives, actions, and agendas, affecting other facets of the bilateral relationship (Harold).'" The United States and China still do not trust each other, even in cyberspace. To a realist, this would make sense as both countries are currently locked in a standoff.

II. Liberalism

The liberal approach to the current tensions between the United States and China could view the situation as a problem that can be viewed through an economic perspective. Both the United States and China have been enjoying decades of trading with each other. Though in recent years, economic ties between the two countries have gotten strained. China's increased economic growth is starting to pose a challenge to the United States' place as the world's top economic power. China in recent years has doubled down on its state capitalist model and as a result has gotten richer. This consistent growth has legitimized the Chinese Communist Party and its state-led economic model." China's economic rise has led to it becoming a major regional power in Asia. It could quickly become a true rival to the world order that is being led by the United States with its economic clout. "The dramatic growth of China's aid abroad has led many to wonder if it is trying to create an alternative global economic order to the U.S.-dominated postwar Bretton Woods system (Weaver)." The rise of China as a major economic power to liberalists could mean that there could be some serious competition between China and the US as both countries are economic powerhouses. This could mean that they could start competing against each other for influence around the world. "China's economic rise has challenged US ability to fundamentally shape the world trade order as the world's dominant economic power. With the US, China now shapes the course of World Trade Organization negotiations (Ross)."As tensions are rising between the United States and China, the world's largest economies, it would be disastrous for the world's economy if both countries were to decouple their economies from each other. This is because China and the United States are economically interdependent of each other. Economic interdependence is a system by which many companies and nations are economically dependent upon each other. China relies heavily on imports into their country from the US and US aligned countries while the US relies on mostly Chinese imports. Liberalists could also think that the economic interdependence between the United States and China would be beneficial in reigning in both sides to incentivize reconciliation. "Overall, the more that China is economically and socially entwined with other major powers the more it gains from the overall system and the more it has to lose in changing the system or engaging in major conflict (Legro)." China is a rational actor and would not want to hamper their increased economic growth by openly challenging the United States according to the liberal view of the current tensions between the two countries.

III. Constructivism

The constructivist approach to the current tensions between the United States and

China could view the problem as China challenging the norms and ideals that have been set into place by the United States. As China's rise is becoming more intense, their military is rapidly improving as well as their economy. This gives them an edge against the United States on the international stage. For example, China is increasing their influence in the Asia-Pacific region. They used to be minor trading partners with the countries in the region as they mainly relied on trade with the United States but in recent years, they have slowly began to increase their influences in the area and have begun the process Of eroding the US as the top player in the region. "With a surge in Chinese trade, investment, loans, development assistance, and tourism, China has become a major player in the Pacific Island region over the past several years… Traditionally China has focused its economic and diplomatic engagement on its eight diplomatic partners in the region, but more recently it has begun to step up engagement with the other countries in the region as well (Searight)." Increased economic and diplomatic moves by China in the region is going to change the way that those countries deal with the United States. The United States in recent years has taken a more assertive stance in the region to slow down China's influences. "The Pacific constitutes an integral part of the US Indo-Pacific strategy which first appeared in the US President Donald Trump's remarks at the APEC CEO Summit in Vietnam in November 2017 and highlighted Washington's determination to promote a rules-based free and open region in response to a more assertive China (Zhang)." The Trump admin compared to the Obama admin is taking a more aggressive stance on China. To a constructivist, they might think that this means that the increasing competition between the US and China could start a new era of tensions. In recent years, China has made strides to overturn US influence to gain international support. "China's upward economic trajectory, during the last two decades, has created a possibility that it could overtake the economies of the North American and West European states. If this happens, then China would be in a position to challenge the economic and the possible political leadership, particularly within regional organizations and international regimes (Tehseen)." To a constructivist, it might look like China will use the advantages that it has through its economic growth to challenge the norms and ideal that have been a staple in international relations. Such a thing could have ramifications in the future. Though it looks like a conflict could arise in the coming years, both the United States and China are rational actors. "Pragmatic considerations in both Washington and Beijing generally saw leaders on both sides seek to avoid confrontation and conflict which would have serious negative consequences for their respective interests (Sutter)." It should be in their best interest to not get involved with conflicts with each other and instead find ways to coexist with each other as the two most powerful countries in the world.

IV. Democratic Peace theory

Comparative politics could also explain the issues that could come into play with the rise of China. One part of comparative politics is the democratic peace theory. The democratic peace theory is the theory that democratic countries do not attack each other and mainly go to war with countries that are authoritarian. China has recently become an authoritarian state with President Xi Jingping declaring himself president for life 2 years ago. The United States is a democratic country and is also the leader of the free world. If both countries are not careful with how they interact with each other, conflict could arise in the future. One example of how there could be conflict with China when applying the democratic

peace theory is China's stance on Taiwan. For decades, China has viewed Taiwan and has stated that it will reunite with the mainland whether by peaceful means or an invasion to reunify the island with mainland China by force. Taiwan is a democratic country that is protected by the United States. In recent weeks, the tensions in the region have become more flamed with China sending naval vessels and its air force near its borders while the United States sends its own naval vessels to transition the strait of Taiwan to show its commitment to Taiwan's defense. The United States has scaled down arms sales to Taiwan to try and ease tensions, but it appears to not have changed the situation. "Indeed, reduced arms sales could increase Beijing's expected costs of conflict… to the extent that proponents of reduced arms sales are right that such a policy shift in Washington will lead to improved relations with Beijing, it could give the PRC a greater stake in a stable US-China relationship—which would, presumably, be undermined by PRC initiation of military conflict against Taiwan (Chen)." The United States wanted to ease tensions with China by easing arms sales to Taiwan to please China, but it only emboldened China to attack Taiwan in the future. If China goes forward with its threat to reunify Taiwan by military force the US could possibly step in to enforce the democratic peace theory against the Chinese authoritarian regime. Support for Taiwan has skyrocketed under the Trump Administration. Democrat controlled congress has also approved legislation that supports Taiwan. "The magnitude and scope of Washington's support to Taiwan under the Trump administration has surpassed previous US administrations. Washington continues to assist the Taiwan military, and the US Congress enacted the Taiwan Travel Act of 2018 and the Taiwan Allies International Protection and Enhancement Initiative Act of 2019 (Hu)." The United States' commitment to the defense of its democratic countries that it is allied with raises the chances of a conflict with China as it rises and seeks to spread its influence around the world.

V. Capitalist Peace Theory

Another comparative approach to the current tensions between the United States and China is the capitalist peace theory. Like the democratic peace theory, the capitalist peace theory is that developed market-oriented economies have not engaged in war with each other, and rarely enter into low-level disputes. People that view the tensions between China and the United States through the lens of the capitalist peace theory might think that tensions between the two might not lead into conflict because both countries engage in trade heavily with each other. Severing trade ties would do major damage to both countries' economies. Working with China instead of having a more confrontational approach to them could benefit both countries' economies with cooperation. "President George W. Bush chose this approach, and it has been successful. U.S.-Chinese relations are more productive today than ever before, partly because President Bush engaged Beijing and did so based on the recognition of Chinas twin priorities: territorial integrity and economic growth (Paulson)." Both the United States and China understand the risks that they face if they were to take a more confrontational approach with the other. In recent times, the United States and China have created organizations like the U.S.-China Strategic Economic Dialogue (SED) to manage tensions that rise between them to ensure that economic ties between the two can continue to grow. The prosperity of both China and the United States depends on the ability of each to achieve balanced economic growth, on stable and vibrant trade and financial regimes, on diverse and dependable energy sources, and on sustainable progress that protects human health and the environment. Though the United States enjoys its economic

relationship with China, it should also be vigilant and not become too comfortable with them to ensure that China does not have too much influence over the United States. Capitalist peace theorists will think the United States will seek to be more direct and vigilant in its efforts to advance U.S. interests. Such an approach will inevitably create tensions but that is a common occurrence in international relations. There is nothing wrong with enjoying a good economic relationship with China. The United States should however make sure that China does not find ways to undermine the United States.

VI. Authoritarian Instability

Authoritarian instability is another comparative political approach that people can use in the study of the tensions between the United States and China. Authoritarian instability is when the foreign policy of an authoritarian state is interfering with other nations. China's increasing influence in Africa is viewed by some as authoritarian instability. "Drawing clear distinctions with the European colonial past and Western policies that China believes are based on a paternalistic interference in political affairs, China promotes its presence in Africa as based on equality, mutual respect, and mutual benefit (Hanauer)." China's influences in Africa to outsiders look like they have good intentions. Western think tanks however have concerns with what is taking place in the region. Western observers believe China does not have good intentions for their expansion in Africa as they see China having an 'insatiable' and "voracious" appetite for mineral resources. They see this as nothing more than a neo-colonial grab for raw materials that perpetuates African countries' underdevelopment. China's support of dictators in Sub-Saharan Africa is something that can be viewed as authoritarian instability. China's support of those dictators suppresses the efforts made by the international community as well as the citizens of the country to overthrow them. One other aspect of authoritarian instability is how China's race for resources around the world including Africa can cause for there to be some friction with other countries. China is a country where they feed their people and take in resources through mainly imports as their domestic production cannot keep up with demand. They are forced to look abroad for resources. One region in the world that has a potential of causing a conflict in the future is the South China sea. "More recently, a 2010 USGS assessment of undiscovered resources in areas in the South China Sea arrived at an estimate of 11 billion barrels of oil and 145 trillion cubic feet of natural gas (Economy & Levi)." Many countries have claims in the area due to its richness in resources, but China has made illegal claims throughout the area and has even build military bases in the middle of the ocean. China's illegal actions in the South China sea are being disputed by the US Navy and are also being disputed by the countries whose territory is being violated in international courts.

VII. Economic ramifications

With the rise of China, there could be economic ramifications that could occur if the United States does not have a peaceful relationship with China as their economy is huge and is rapidly growing. Their economy is poised to overtake the United States'. One other issue that arises with the economic issues with the Chinese is the competition that is currently taking place between the two economic powerhouses. One area of contention is the tech industry. The United States is the current leader of the world in the tech industry, but China is slowly catching up. The United States wants to keep ahead of China

in the tech industry because of China's civilian organizations relationship with the Chinese military. "Finally, advanced traded sectors and many of the technologies associated with them are critical to America's ability to field a robust military force, particularly as China's technological capabilities and efforts at 'civil-military fusion' advance (Atkinson)." If China were to surpass the United States in the tech industry, it would be a national security issue for the United States. The United States wants to maintain an edge on China in the tech industry so that the Chinese military would not be able to dominate the tech industry which would put the United States' industry at risk. Other economic ramifications for the rise of China have taken place during the COVID crisis that has taken the world by storm. In the beginning of the pandemic, the United States did not have enough PPE equipment for everyone including medical workers. This could be blamed on legislation passed in 2000 that allowed for China to have normal trade relations with the United States. "[US multinationals'] goal from the beginning was to transfer the production of many products from American soil to Mexican soil or Chinese soil, to take advantage of foreign low-wage, nonunion labor, and in some cases foreign government subsidies and other favors (Lind)". The United States got itself into this debacle by allowing China to have an advantage over the United States because of cheap labor. Now China has an unfair advantage over the United States in the economic arena. China's malicious acts targeting the United States have not been uncommon as they have been doing this for decades. "…China was accused of currency manipulation that deepened the US trade deficit, and of stealing technologies and commercial secrets (Propper)." If the United States wants to even the playing field with China, they should seek a way to negotiate with them or continue the current trade war being waged to try and force them to the negotiation table.

In this literature review, I discussed the realist, liberal, constructivist, views on the rise of China and the US's response as well as how the democratic peace theory, capitalist peace theory, and authoritarian instability can play a part in determining what could possibly happen and how the United States could respond to China's rise. There are tensions between the two countries across military, economic, and diplomatic arenas. If both sides are not careful, there could be a conflict in the near future. Both sides should sit at the negotiation table so that they can talk and find a peaceful solution to the current dilemma between them.

Conclusion

As China has been gaining massive economic and military power, some scholars believe that a confrontation is possible between the United States and China. This is because they believe that the United States and China could view each other as obstacles to their influences around the world. As China grows in power, it will soon become an equal to that of the United States and could possibly surpass it. This begs the question on whether the United States should find ways to coexist with China as rival powers in a bipolar world much like the United States did with the Soviet Union, or if conflict between the two is inevitable as there are various points of contention that they have with the other. As discussed in the essay, China and the United States have to either find ways to coexist with the other, or there will be a high chance of the United States and China engaging in a limited conflict with the other if they are not careful.

Hypothesis

The reason scholars are debating on whether the United States and China can coexist with the other or if conflict is inevitable is because of the different view of international relations that are analyzing this subject. Those that view the standoff through the lens of a realist might believe that conflict is inevitable because of the areas of contention that the United States has with China. This being the United States' support of Taiwan which China views as a renegade province which it wishes to reunite with whether it be through peaceful means or through military conquest. A scholar viewing this subject through the lens of a liberalist might believe that conflict is less likely to happen as the United States and China share a closely knit economic relationship. As China's economy grows, its relationship with the United States will be more competitive as China seeks to unseat the United States as the number one economic power. Conflict between them is more likely if the United States and China seek to decouple their economies from the other. This is because countries are less likely to go to war with the other if they depend on each other for trading purposes.

A constructivist would view this conflict as the United States seeking to prevent the spread of Chinese influence in areas of the world that the United States has a presence in. For example, China has been expanding its presence in South Asia and, Western Pacific regions, and also Africa. China's increased influence in these regions complicates the United States' Indo-Pacific strategy to counter the rise of China's influence in the region by seeking allies to stand with the United States in efforts to bring China's influence in the region to a halt. My hypothesis in conclusion would be: If the United States and China maintain a strong economic relationship, they would not go to war with each other.

I concluded that both the United States and China would rather not engage in a conflict with the other as their economic relationship would be sacrificed. Diplomacy will work out in favor of the United States and China though it will be difficult as they seek to outdo the other on the global stage. To avoid unwanted military confrontations, the United States military commanders has close communication with their Chinese counterparts to prevent any miscalculations. These military hotlines also serve as a de-escalation tactic if a hypothetical conflict were to start. The United States and China can also make strides to mend their economic relationship through diplomacy. I do not believe that either side wishes to engage in a military conflict with the other as that would be catastrophic for both of them. In conclusion, the United States and China will not seek a military confrontation with the other but will instead enter into an era of competition.

Methodology

This thesis project is based and formulated through the use of qualitative analysis, in particular, though the use of case studies. Different case studies are used analyzed in this thesis project. The ultimate goal of this thesis was to analyze where the United States and China would go to war with each other or if they will be able to coexist with each other.

One area in the world where this issue can be specifically studied is Ethiopia. The United States does not have strong relations with the African country, so the Chinese have

stepped in to fill the void that the United States left. According to Chakrabarty, "Bilateral trade between the two countries expanded rapidly, and China is currently the country's top export and import partner." With the United States not showing interest in Ethiopia, China has become its largest trading partner instead and is beginning to form a long-term relationship with the African country as both enjoy the economic relationship, they have with each other. This could signal a trend for the region as the United States is losing its race for influence in Africa against China, which already has a major lead. According to Chakrabarty, "Given Ethiopia's strategic importance, Chinese investment and aid directed to Ethiopia are also aimed at providing a model for other African countries. The main beneficiaries are local consumers and commercial traders who bring manufactured consumer goods from China for sale in Ethiopia as well as entrepreneurs engaged in establishing small-scale factories and service centers by buying machinery from China." China's investments in Ethiopia will serve as a basis for their continued expansion into the African market and further their economic ties with them. The United States so far has not been able to keep up with Chinese influence.

The different case studies center on three areas in which the United States and China compete with each other. In the geopolitical arena, through competition in the military field, and competition in the economic field. These areas of competition are unique but they both provide different sources of information that were helpful when doing research for this topic. I have also concluded after analyzing this data that the United States and China will not go to war with each other. This is because China and the United States have enjoyed decades of economic trade with each other. They would rather maintain this economic relationship instead of going to war. If a conflict were to break out, they would act quickly to contain it and make sure that it does not get out of control.

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Family and Cultural Predictors of Subjective Well-Being among Latina/o/x College Students

Abstract

Family plays a crucial role in the subjective well-being of Latina/o/x college students. Along with family, Latina/o/x college students are also faced with cultural variables unique to Latina/o/x households that have an impact on the development of mental health within the population. This study investigates how parent-child bonding, family cohesiveness, and family coping impact the mental health of Latina/o/x college students. It also looks at how cultural variables such as familismo have an effect on the mental health of these students. In order to conduct this study, 338 self-identified full time Latina/o/x college students were recruited from a west coast university. The students were administered an online survey that include the Family Adaptability and Cohesion Scale (FACE-IV), Family Coping Index (FAMCI), Parent-Child Bonding Scale (P-ChB), Latino Value Scale (LVS), and Satisfaction With Life Scale (SWLS). A series of bivariate correlations were then conducted to see the interrelationships between the variables of interest. We found correlations between family and cultural variables on the psychological well-being of Latina/o/x college students.

Families serve as a protecting factor to individuals experiencing psychological distress. In Latina/o/x families, the bond between parents and child is essential for acculturation and their overall psychological well-being. From a young age, traditional Latina/o/x parents emphasize interdependence (Fuligni, Tseng, & Lam, 1999; Triandis, 1995); studies have reported that Latina/o/x adolescents who had a close relationship with their parents had higher self-esteem, lower rates of depression, less antisocial behavior, and less risk-taking behaviors than those of fellow peers (e.g., Love & Buriel, 2007). Furthermore, research on Latina/o/x students and college education emphasizes that family support is positively related to coping with stress, academic growth, and positive psychological well-being (Rodriguez, Myers, Morris, & Cardoza, 2003). Despite the developing literature in this area, there are few studies looking at the relationship between family variables (e.g., family cohesion, family coping) and the psychological well-being of Latina/o/x college students. Thus, the purpose of this study is to address this gap and identify how family cohesiveness, family coping, and cultural values predict the well-being of Latina/o/x college students.

Immigrant Families and Psychological Well-being

Latina/o/x immigrant families experience acculturation, the process of individuals assimilate to a dominant culture (Cabassa, 2003). Parents and children acculturate at different rates and through different experiences. Studies have shown that children of immigrant families acculturate faster to U.S culture due to their interactions in the educational system and forming relationships with English speakers. Much of the work that investigates the effects of acculturation on the well-being of Latina/o/x youth focuses on them solely, not their parents. However, the emerging literature suggests that the acculturation of parents plays a vital role in their children's well-being. For instance, Mexican-American parents practice more permissive parenting styles, while Mexican immigrant parents practice more authoritative parenting styles (Buriel, 1993; Bulcroft,

Carmody, & Bulcroft, 1996). Research on immigrant families shows that the acculturation process of parents influences the emotional outcomes of first-, second-, and higher-generation of Latina/o/x youth. To illustrate, in Asian and Latina/o/x children, more acculturated and higher generation youth have a higher self-esteem than those who are less acculturated and youth belonging to the first and second generation (Driscoll, Russell, & Crockett, 2007; Bankston & Zhou, 2002).

Satisfaction with family is considered a component of psychological well-being (Vandeleur, Jeanpretre, Perrez, Schoebi, & McBride-Murry, 2009) and is positively associated with the well-being of immigrant children and adolescents (Dew & Hueber, 1994). Youth who report having a positive relationship with their parents have shown a positive relation with psychosocial competence and are less susceptible to antisocial peer pressure which contributes to subjective well-being (Sim, 2000). Further, scholars have found that adolescents with positive parental relationships are equipped with the resources to overcome difficult situations later in life, hence improving overall well-being in adulthood (Ben-Zur, 2003).

The ability for parents to agree with their child on family expectations and obligations show that their children report having higher life satisfaction. These findings suggest that families who practice effective communication and focus on emotional support promote psychological well-being among youth (Park, 2004). High levels of parental warmth and support are associated with greater self-esteem, lower depression, and lower levels of anxiety among adolescents (Driscoll et. al., 2007).

Latina/o/x Families

The role of family is also a positive predictor of academic success in Latina/o/x college students. Rodriguez et. al. (2003) provide evidence to support the need for Latina/o/x families to provide not only emotional, but also financial support to the student in order to ensure success in higher education. Researchers also state that the interdependence between Latina/o/x students and their familial obligations along with the requirements for school can contribute to the difficult adjustment of school as well as to the low retention rate of these students (Lopez, 1995).

Among Latina/o/x families, the bond or cohesion experienced between family members may be a contributing factor to maintaining a more positive well-being. Family cohesion is the emotional bond experienced between family members (Olson, Russell, & Sprenkle, 1982) and in Latina/o/x families, cohesion has been identified as a protective barrier against external stressors (Hovey & King, 1996). Cohesion in Latina/o/x families is considered to be a factor in the closeness of relations, loyalty, reciprocity, and solidarity among the members. Evidence shows that high levels of cohesion are related to lower levels of psychological distress among

Latina/o/x groups (Rivera et. al., 2008). Furthermore, studies report that evidence-based interventions promoting family cohesion among Latina/o/x families promote a positive psychological well-being among children and adolescents (Leidy, Guerra, & Toro, 2010). Ethnic minority students are often subjected to unique life stressors (e.g., discrimination,

minority status) when transitioning to college compared to their White peers (Nora & Cabrera, 1996; Schmader, Major, & Gramzow, 2002). These stressors require students to rely on effective coping strategies (e.g., seeking support, self-efficacy) to maintain positive well-being. Coping is a response to specific situations that individuals go through that cause distress (Phinney & Haas, 2003). Specifically, family coping is the effort by either individual family members or the family as a whole in order to lessen or handle the demand for the family (McCubbin, Thompson, & McCubbin, 1996). Literature on family coping has uncovered that families who have more coping behaviors are more successful in adjusting to stressors (McCubbin et. al., 1996).

Latina/o/x college students come from diverse backgrounds, with family and culture being focal points. One specific cultural value seen among many Latina/o/x families is Familismo. A value that emphasizes closeness and loyalty among family members, it also requires for members of the family to put the needs of the family first over individual needs (Vega, 1990). Studies conducted by Fuligni and Pederson found that adolescents who had a strong role in their family, supported, and assisted family members demonstrated a healthier psychological well-being (2002). A strong connection with family was also found to be a protective factor in maintaining academic success in college. More specifically, Gloria and Rodriguez investigated counseling interventions used by therapists with Latina/o/x college students, and found that therapists who use therapeutic measures that emphasized contact with family (e.g., sending emails, sending and receiving care packages) had a heightened sense in familial and education support, which overall contributed to a positive increase in psychological well-being (2011).

Familial social support is essential to maintaining a healthy psychological well-being. Social support has been found to be an effective buffer against life stress among high-risk and disadvantaged children, children of divorce, and children with learning disabilities (Kerres-Malecki & Demaray, 2002; Cobb, 1976). Along with life stress, social support has also been shown to be a buffer for academic success among adolescents and children. Specifically, parental support has been found to be a key factor in the academic success of disadvantaged students (Becker & Luthar, 2002; Dubow & Tisak, 1989). Researchers have found that social support plays a protective and stabilizing role, meaning students with adequate social support are more likely to have positive life outcomes such as academic achievement (Luthar et. al., 2000; Becker & Luthar, 2002; Dubow & Tisak, 1989).

Research on Latina/o/x academic achievement has uncovered key personality traits related to positive academic success. Three of the most commonly cited attributes are: cultural pride, self-efficacy, and a drive to success (e.g., Arellano & Padilla, 1996). Further, Latina/o/x college students reported that parental support and encouragement were vital in their educational successes. Studies conducted on Latina/o/x parents found that mothers rated the importance of education for their children higher than European American mothers. Latina mothers also demonstrated more support and enthusiasm for the education of their children (Stevenson et al., 1990). Hence, the importance of strong family bonds are critical for the adaptation of Latina/o/x parents and their children.

Familismo is a protective factor for psychological and physical health of Latina/o/x individuals (Ross, Marrinan, Schattner, & Gullone, 1999). Under the stress-buffering

model, Latina/o/x adolescents who have strong social relationships (eg., parents, siblings) are also more likely to mitigate the negative effects of stress during stressful life events (eg., transition to college, final exams) (Corona, Campos, Chen, 2016). In addition, literature shows that values hat prioritize family overself (e.g., familismo) have a strong association with high self-esteem, life satisfaction, and overall well-being (Schwartz et. al., 2010). Although specific associations with familismo and physical health have yet to be determined, scholars have speculated a link between quality of life, self-care, and disease experience in Latina/o/x patients being treated for diabetes, breast cancer, and HIV (Katiria, Perez & Cruess, 2014).

The literature presented highlights the importance of studying how family factors influence the psychological well-being of Latina/o/x college students. To our knowledge, this is the first study looking at the interrelationships between family cohesion, family coping, parent-child relationships, and psychological well-being. Thus, this study addresses this gap in the literature. The purpose of this study is to examine the interrelationships of family cohesion, family coping, and parent-child relationships with Latina/o/x college students' psychological well-being. Our research questions include:

1. What is the relationship between family variables such as family cohesiveness, family coping, and parent-child relationships with the Latina/o/x college students' psychological well being?
2. What is the relationship between cultural variables such as Familismo and Cultural Pride, with the Latina/o/x college students' psychological well being?

Method

Participants

A sample of 338 adult self-identified Latina/o/x full-time college students attending a west coast university identified as a Hispanic Serving Institution were recruited for this study. Data was collected through Qualtrics online survey.

Data Collection

Demographics. Demographic information was collected; which included questions regarding age, gender, ethnic/racial background, parental education level, class standing, marital status, major, their grade point average, place of birth, generation status, sexual orientation, native language, second language, education level of parent(s), and birth order.

Family Adaptability and Cohesion. The Family Adaptability and Cohesion Scale (FACES-IV; Olson, Gorall, & Tiesel, 2006) measures the dimensions of family cohesion and family flexibility using six subscales. The two balanced subscales look at family cohesion and balanced family flexibility. The FACES-IV also contains four unbalanced subscales measuring high and low extremes of cohesion and flexibility. The first two unbalanced subscales measure cohesion, which are disengaged and enmeshment. The last two of the subscales provide rigid and chaotic scores. Sample items for the balanced cohesion and flexibility scale include, "Family members are involved in each other's lives" and "My family

is able to adjust to change when necessary." For the unbalanced disengaged, enmeshment, rigid, and chaotic scales, sample items include, "Our family seldom does things together", "We spend too much time together", "Our family is highly organized", and "There is no leadership in our family" (Olson et. al., 2006). Alpha reliability analysis was conducted in order to examine the internal consistency of the six scales and showed very good reliability among the scales. The reliability of the six scales were: Enmeshed= .77, Disengaged= .87, Balanced Cohesion= .89, Chaotic= .86, Balanced Flexibility= .84, Rigid= .82 (Olson, 2011).

Family Coping. The Family Coping Index (FAMCI; McCubbin, Thompson, & Elver, 1995) is an assessment designed to measure coping efforts of at-risk youth, youth offenders, and youth in residential treatment programs. Within the FAMCI are three subscales, which are (a) seeking professional and spiritual guidance, (b) seeking family and neighbor support, and (c) affirming the family's confidence (McCubbin et. al., 1995). It consists of 24-items using a 1 (strongly disagree) through 5 (strongly agree) Likert scale. Sample items include, "Sharing our difficulties with relatives", "Believing we can handle our own problems", and "Knowing that we have the strength within our own family to solve our problems." The FAMCI was designed to be used both with families of Causcasian and African American minority youth. The FAMCI has good internal consistency with an overall alpha of .85. The alphas for the subscales are .80 (seeking professional and spiritual guidance), .78 (seeking family and neighbor support), and .70 (affirming family's confidence) (McCubbin et. al., 1995).

Parent-Child Bonding. The Parent-Child Bonding Scale (P-ChB; Kim, 1989) assesses the relationship between the parent and child. The P-ChB consists of 10 items and uses a four point scale ranging from Strongly Agree to Strongly Disagree. Sample items include, "I respect my parents", "My parents and I have similar interests", and "I feel my parents love me wholeheartedly". The P-ChB has been found to have good internal consistency (.75 to .95) with culturally diverse college samples (Kim, 1989; Love & Buriel, 2007; Morales & Wang, 2018).

Latina/o/x Values. The Latino Value Scale (LVS) was developed by Kim, Soliz, Orellana, and Alamilla (2009). The scale consists of 35 items and it uses a 1 (strongly disagree) through 4 (strongly agree) Likert scale. The LVS also contains two subscales (a) Cultural Pride and (b) Familismo. The Cultural Pride subscale consists of 10 items, sample items include, "On does not need to follow one's cultural customs" and "One does not need to be loyal to one's cultural origin". The Familismo subscale consists of five items, some of the sample items include, "A man must provide for his family financially", and "One should never bring shame upon one's family". Overall, the LVS has a coefficient alpha of .88 and .85 with subscale coefficient alphas differing in range (Kim et. al., 2009). The Cultural Pride subscale has a coefficient alpha of .89 and .85; the Familismo subscale has a coefficient alpha of .75 and .68. Kim et. al. also provides a 2-week test-retest reliability, the LVS has a reliability of .78 and both the Cultural Pride and Familismo subscales have a reliability of .75 (2009).

Psychological Well-Being. The Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). The SWLS is used to measure the life satisfaction component of subjective well-being. The scale is a 5-item assessment and uses a 1-7 rating system with 1

being Strongly Disagree and 7 being Strongly Agree. Sample items include , "In most ways my life is close to my ideal" and "If I could live my life over, I would change almost nothing." The highest score a participant can achieve in this instrument is a 35 which indicates high satisfaction with life. The coefficient alpha for the scale ranged from .79 to .89 (Diener et. al., 1985).

Procedures

Results

A series of bivariate correlations were conducted to see the interrelationships between the variables of interest (see Table 1). The analysis showed that family cohesion was positively correlated with psychological well-being, $r(328)= .20$, $p < .01$. Results also indicated a positive correlation between family coping and well-being, $r(328)= .29$, $p < .01$. Further analysis on cultural variables found that familismo and psychological well-being were not significantly correlated, $r(328)= .014$, $p < .806$. However, results indicated a negative correlation between cultural pride and psychological well-being, $r(328)= -.20$, $p < .01$.

A multiple regression analysis was conducted to assess how the family and cultural variables predicted psychological well-being among Latina/o/x college students. The results of the analysis showed that the strongest predictor of psychological well-being was Cultural Pride (M=27.36, SD=3.41), $F(10, 241)=13.05$, $p<.01$, accounting for approximately 35% of the variance.

Discussion

The purpose of this study was to determine the effect family and cultural variables had on the psychological well-being of Latina/o/x college students. Analysis determined there was a positive correlation between family cohesion and family coping on the well-being of these college students. Results also showed a negative correlation between parent-child bonding and psychological well-being. Furthermore, analysis on cultural variables (e.g., familismo and cultural pride) found that cultural pride and well-being were negatively correlated. Surprisingly, results also showed that there was no significant correlation between familismo and psychological well-being. When conducting multiple linear regression, results indicated that cultural pride accounted for 35% of the variance in psychological well-being.

The data analysis demonstrated that the most significant predictor of psychological well-being was cultural pride. Although the results indicated a negative correlation between cultural pride and well-being, there is sparse literature to support this relationship. Arellano and Padilla conducted a qualitative study and found that Latina/o/x students saw their ethnicity as a source of pride, strength, and support; these students relied on their social identity and Latino ethnicity as a support system outside their own personal attributes (1996). Participants of Arellano and Padilla's study shared that the bond they had with other Latina/o/x students and organizations was imperative in maintaining their relationship with their culture, as well protectively working towards improving their life and the life of other

Latina/o/x students.

On the contrary, familismo had no significant impact on the well-being of our participants. Studies conducted on familismo have been linked as a buffer in maintaining a healthy psychological well-being. Schwartz et. al. reported that individuals who put their family over oneself serves in promoting individual well-being (2010). The results of this study do not support the link between psychological well-being and familismo. Schwartz et. al. also shared that Latina/o/x individuals tended to score lower on cultural values over time as they acculturated to American culture (2010).

Family cohesion and satisfaction, as anticipated, had a significant correlation with psychological well-being. Positive experiences with family is one of the most important sources of well-being and as a buffer against distress. Familial cohesion is the degree of togetherness, closeness, and emotional bonding family members have towards one another, which has been positively correlated to well-being and life satisfaction in adults (Vandeleur et. al., 2009). The results of this study support this argument; moreover, the importance of healthy bonds between family members will result in Latina/o/x college students reporting a healthy psychological well-being.

Parent-child relationships were also significantly associated with psychological well-being. Park reported that parents who had a healthy relationship with their child allowed for their children to build autonomy, but more importantly their children could rely on them as a source of support, both these factors were linked to life satisfaction (2004). In addition, studies on immigrant youth emphasize the importance between mother and child; parenting styles have been shown to differ between immigrant parents and those who are native born. Different parenting styles (e.g., authoritative, permissive) has been related to behavior and emotional well-being in their children later in life (Driscoll et. al., 2007).

Implications

For future research, it would be helpful to further investigate cultural values that pertain to Latina/o/x college students. Results of this study do indicate a correlation between cultural values and psychological well-being, so it is important for these values to continue being researched to add to the literature. The findings in this research can help mental health professionals working with Latina/o/x students promote well-being through family relationships, as well as looking at their Latino culture as a source of strength to power through adversity. Universities and colleges can also use this research to create more support programs that align to the culture of their students. A qualitative study would also be beneficial, it would allow for a more in depth, detailed look into the lives of Latina/o/x college students and it opens ideas for future studies.

Limitations

One limitation encountered in this study was the recruitment process for participants. Participants were recruited using the psychology department's SONA system, which allows for students to participate in studies in order to receive extra credit for their courses. The researchers can infer that participants have some knowledge with psychology which may

affect their response to the questions. Also, conducting an online survey survey with various scales may cause the participants to lose focus which can cause them to not answer the questions accurately. The sample size was also another limitation. We obtained a total of 328 participants, a larger and more diverse sample may have increased statistical power. For future research, investigators may want to recruit more participants of diverse backgrounds, which includes a variety of other majors. Researchers may also want to recruit participants using other systems of recruitment, rather than the system used by the psychology department. Even though there are some limitations to this study, indications for future research can be helpful in continuing the exploration of the interrelationship of family and cultural values, and their impact on psychological well-being.

In conclusion, it is important to study whether family variables, such as family coping, family cohesion, and parent-child relationships, along with cultural variables such as familismo and cultural pride have an effect on the psychological well-being of Latina/o/x college students. It is crucial to look into this population because it is becoming a growing community who is facing adversity in higher education. It is imperative to understand the impact family and culture have on their well-being and their ability to overcome hardships.

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Tables

Table 1

Subjective Well-Being, Family Cohesion, Family Coping, Familismo, Cultural Pride:
Correlations (N=338)

Variables	1	2	3	4	5	M	SD	α
1. Well-Being	-					22.18	6.13	.89
2. Family Cohesion	.20**	-				37.40	7.23	.82
3. Family Coping	.29**	.45**	-			72.82	13.79	.85
4. Familismo	.014	.19**	.18**	-		12.25	3.08	.70
5. Cultural Pride	-.20**	-.03	-.04	-.003	-	27.36	3.41	.79

$*p < .05$ $**p < .01$

Table 2

Summary of Hierarchical Regression Analysis for Variables Predicting Well-Being (N=252)

	Latina/o/x College Students		
Variable	B	$SE\ B$	β
Family Cohesion	.004	.057	.005
Family Coping	.031	.028	.071
Familismo	.010	.107	.005
Cultural Pride	-.292	.101	-.153
R^2	351		
F for change in R^2	13.05		

$*p < .05\ **p < .01$

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Synthesis and Computational Evaluation of Bisbenzylisoquinoline

Abstract

Worldwide diseases that affect the world population causing millions of deaths annually are due in part to treatments that are losing their effectiveness, have significant negative side effects, or have no treatment at all. The family of Bisbenzylisoquinoline (BBIQ) natural products may provide an effective starting point for new and/or preventable treatments for the parasitic disease leishmania and the global pandemic disease Covid-19, but the methods for their synthesis are limited. The BBIQs are macrocyclic compounds containing two benzyl- substituted tetrahydroisoquinoline rings connected though diarylether linkages. Many synthetic studies have been conducted; however, no systematic studies have been performed to determine how these molecules exhibit their biological activities including antiparasitic, anti-inflammatory and antiviral activities. The intent of this study is to use a double Piclet-Spengler reaction to provide a BBIQ core of the natural product Tetrandrine and to use computational modeling techniques in order to investigate the antiviral potential of Tetrandrine and other BBIQs by comparing them to Cepharanthine, a BBIQ known to inhibit the SARS-CoV-2 virus. This study has the ability to provide compounds that are useful in the long-term goal to find new and/or preventable treatments for worldwide diseases.

Major Objectives

The objectives for this experiment are to synthesize, evaluate and explore new and existing BBIQs that will provide effective starting point in treatments for Leishmaniasis and Novel coronavirus 2019 (COVID-19).

Background

The Bisbenzylisoquinoline (BBIQ) class of natural products are macrocyclic molecule compounds that consist of over 300 members that exhibit many biological activities including antiparasitic, anti-inflammatory and antiviral properties. These macrocyclic molecules show a rich diversity in their structural components and are characterized with two benzyl or phenylethyl substituted tetrahydroisoquinoline rings connected through diarylether linkages.5,6 Many approaches have been taken; however, no systematic studies have been performed to determine how these molecules function as antiparasitic, anti-inflammatory and antiviral compounds. Some of these worldwide diseases that BBIQs have the potential to prevent and/or cure include Leishmaniasis and Novel coronavirus 2019 (COVID-19).4

Leishmaniasis is a worldwide parasitic disease, which infects hosts such as humans, dogs, and rats, and affects parts of the skin, internal organs of the body and mucous membranes. Leishmaniasis is transmitted through a bite from an infected sand-fly and is considered a neglected tropical disease. It's commonly seen more in the underdeveloped parts of the world such as regions in America, Africa, Eastern Mediterranean, Europe,

and South-East Asia.8 The estimated mortality rate of leishmaniasis is approximately 60,000 per year. Currently, effective treatments for leishmaniasis include the use of toxic heavy metals such as pentavalent antimonials, antimonate, sodium stibogluconate, meglumine pentamidine, amphotericin B, miltefosine, paromomycin, and sitamaquine.2 Unfortunately, leishmaniasis parasites have developed resistance to these drugs over the years causing about 5 to 70% of the affected individuals to not respond to the current treatments. Researchers have made it a priority to find a safe and effective anti-leishmania drug, including over 300 natural products and over 400 synthetic molecules that have been shown to produce antileishmanial activities in the past decade alone.6 Based on the literature precedent the ability to develop and make use of the modern methods within organic synthesis could potentially create a positive effect by developing new molecules with antileishmanial activity and exploring their function.

Novel coronavirus 2019 (COVID-19) is a global pandemic disease that caused one of the world's largest outbreaks since the early 1900s. This disease is caused by the severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) virus, which is closely related to the severe acute respiratory syndrome (SARS) virus, affecting the human respiratory system leading to a very high mortality rate.7 COVID-19 is transmitted through respiratory droplets from person to person and is considered a deadly disease.3 Recently, it has been found that a few drugs received emergency licenses. However, due to the exponential growth rate of infected individuals the need for the development of anti-SARS-CoV-2 agents is to be found. Cepharanthine (CEP), a natural alkaloid, is part of the BBIQ family and is considered a potential treatment for COVID-19 due to its properties produced. CEP is a drug that was extracted from the plant Stephania cepharantha. Recently, CEP has been tested against severe acute respiratory syndrome coronavirus (SARS-CoV) and has shown positive results. SARS-CoV and SARS-CoV-2 share a closely related genome sequence indicating that they would also share similar target structure resulting in similar antiviral drugs.7 By using computational modeling techniques CEP was used in order demonstrate the prevention of the primase factor activation site in SARS-CoV and SARS-CoV-2.1 Based on the literature precedent the ability to use CEP as a modeling molecule to compare and to see what other BBIQs would show similar properties, which would create a positive effect by developing new molecules with inhibiting factors from the replication of the human coronavirus sequence.

Experimental Approach

Literature Review. The first step in this experiment is to gain an understanding of the Tetrandrine synthesis in order to better process on how Tetrandrine is produced. Synthesis. The next step is to formulate a multiple synthesis reaction starting with a process known as fisher esterification. Sulfuric acid reacts with methanol in order to esterify the compounds 4-bromophenyl acetic acid and 3-hydroxyphenyl acetic acid which will form a methyl ester yielding methyl 4-bromophenyl acetate and methyl 3- hydroxyphenyl acetate, respectively. Subsequently, once starting material is obtained the next step is to form a diaryl ether using Ullman coupling in which an aryl halide and phenol are coupled together with the help of a copper catalyst to make diaryl ether product. Following this an ester reduction will take place by reaction of reducing reagent Diisobutylaluminium hydride (DIBAL-H) with diaryl ether product furnishing a dialdehyde molecule. Reductive amination

on this dialdehyde molecule will convert each carbonyl group to an amine creating diamine. Finally, a double Piclet- Spengler reaction takes place with the combination of the dialdehyde and the diamine molecule and the help of an acid catalyst to provide the Tetrandrine Core (BBIQ), the final product.

Computational Evaluation. Using computational modeling software such as Auto Dock will be conducted in order to see the potential in other BBIQs, including the tetrandrine core that is to be made, as anti SARS-Cov-2 molecules (Covid-19). This program will let us perform molecular docking in order to create a more specific hypothesis by knowing which parts are thought to do chemical bonding to the protein. We would then use a docking box in order to set boundaries that the molecule is put in. Then, when docking occurs it will make the molecule move anywhere within the box that was set up and we will be able to study the interactions between the spike protein and the molecule. From the data information gathered here we will be able to compare that to Cepharanthine, due to its wide studies already available, which will indicate whether or not this derivative (Tetrandrine) is a good candidate for Covid-19 treatments.
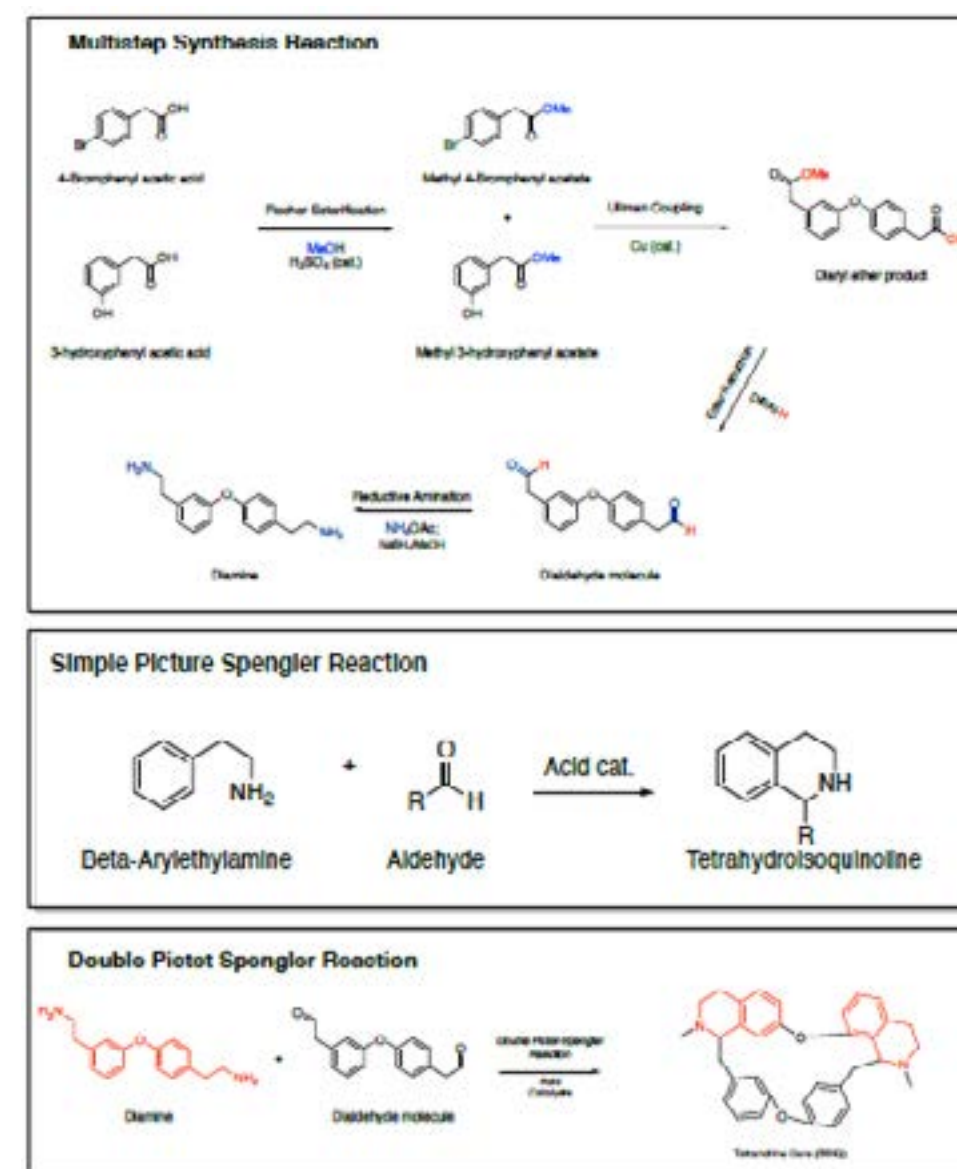
Progress made (Data/Results)

Currently obtained is the 4-bromophenyl acetic acid yielding methyl 4-bromophenyl acetate and 3-hydroxyphenyl acetic acid yielding methyl 3- hydroxyphenyl acetate. By using TLC analysis on the starting material and product a clear separation is indicated as shown in Figure 1. However, as indicated in Figure 2 which is data collected when obtaining 3-hydroxyphenyl acetic acid to yield methyl 3- hydroxyphenyl acetate there wasn't a clear separation of the molecules. This could be due to impurities by the starting material

Figure 1. Represents a TLC plate of the starting material labeled "S" (4-bromophenyl acetic acid) and the product labeled "P" (4-bromophenyl acetate). The big gap in between indicated that this reaction successfully separated through the use of the techniques of apparatus of reflux and rotary evaporation.

Figure 2. Represents a TLC plate of the starting material labeled "S" (3-hydroxyphenyl acetic acid) and the product labeled "P" (methyl 3-hydroxyphenyl acetate). The overlapping in the dots showed there was impurities within the sample there no yield was able to be obtained.

Discussion

Due to the pandemic a pause was put on the laboratory techniques of this experiment. So, a literature review was put into progress in order to familiarize myself with the most recent synthesis of the BBIOs like tetrandrine that utilize similar approaches of the Pictet-Spengler approach. With this expanded knowledge this allowed better interpretation of the double Pictet-Spengler approach in this project. As for using the computational modeling software, Auto Dock, this was unable to be performed due to complications with our technology. However, once this problem is fixed further studies will be done in order to create that specific hypothesis, leading to the goal of creating an effective molecule. With an effective molecule created the ultimate goal of this experiment is then producing an effective and efficient treatment in order to help the body build up its immunity to fight.

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Role of Multicultural Experience in Negotiations: A Boost or a Distraction?

Abstract

So far, there has not been an investigation of negotiators' previous multicultural exposures and interactions and their potentially differential relationship with negotiation process and outcomes. This study seeks to fill in this gap in literature as the first to investigate the role of negotiators' multicultural exposure and interaction levels in negotiations. This present study collected data on 50 students (25 dyads) from the College of Business at California State Polytechnic University, Pomona. Participants are recruited from various Management and Human Resources courses. Participants engaged in a dyadic negotiation exercise scenario by negotiating as a bakery chef and an entrepreneur trying to come to an agreement about setting up a bakery-café. After participating, each student took an online Qualtrics survey that measured levels of information sharing, MCEs, negotiation Subjective Value Inventory, perspective taking, and conflict management style.

Introduction

Ability to negotiate effectively is a key professional skill. If parties can communicate and collaborate in an effective and creative way, through negotiations, they can successfully manage interpersonal conflicts, settle disputes and establish beneficial partnerships and agreements (c.f. De Dreu, Weingart, & Kwon, 2000). Research has found that using creative abilities in negotiations can lead to better and more successful business solutions and outcomes (c.f. Elfenbein, Curhan, Eisenkraft, Shirako, & Baccaro, 2008).

One construct that leads to creative abilities is multicultural experiences. Research shows that multicultural experiences can lead to creative processes (Leung, Maddux, Galinsky, & Chiu; 2008). However, so far, the relationship between negotiators' previous multicultural interactions and economic and subjective negotiation outcomes has not been studied. Therefore, we seek to unpack this relationship further and contribute to existing negotiation literature by answering whether level of negotiators' multicultural experience is associated with enhanced economic and subjective negotiation outcomes. This study examines two opposing theoretical perspectives, namely the 'creative cognition' and 'socialization and positive bias' approaches, to answer our question about this association.

Literature Review

Perspective #1: Creative Cognition Approach

Literature shows that one of the factors associated with creativity is multicultural experience (Aytug, Rua, Brazeal, Almaraz, & González, 2018; Leung & Chiu, 2010; Godart, Maddux, Shipilov, & Galinsky, 2015; Maddux & Galinsky, 2009). Creativity is a complex and multifaceted phenomenon and based on the creative cognition approach, having different experiences with different cultures is associated with enhanced cultural schemas, increased cognitive flexibility, and creative performance (Endicott, Bock, & Narvaez, 2003). The role of

culture in creative development, thinking, and skills is vital in how it shapes behavioral choices in negotiation situations. Research has commonly defined culture as distinctive features of a social group and its behaviors, values, and norms (Brett, 2000). Thus, in cross-cultural negotiation situations, it is crucial to be educated and culturally aware about another culture's approach to the negotiation (Acuff 1997; Morrison et al. 1994). In their cross-cultural study, Storme and colleagues found that culture has an impact on the structure of creative ability (Storme, Lubart, Myszkowski, Cheung, Tong, & Lau, 2017).

Interacting with people from different cultures allows individuals to develop multiple perspectives, cognitive schemas, and cognitive flexibility (Aytug et al. 2018). The more cognitive flexibility and cognitive schemas individuals acquire, the more they can pull this cognitive knowledge and flexibility to solve problems and devise solutions. Being able to utilize new ideas and insights and ability to break through rigid thinking and structured, routine ways enhances creative thinking and problem solving performance (Bink & Marsh, 2000; Finke, Ward, & Smith, 1992; Runco & Chand, 1995; Wan & Chiu, 2002).

Since having multicultural experiences enhance creative abilities and cognitive abilities, it boosts creativity and problem solving as well. Literature has much support for the positive relationship between multicultural experience and creativity. Creativity was found at higher rates in first-and second-generation immigrants (Simonton, 1997) and in bilingual, bicultural and binational individuals (Chang, Hsu, Shih, & Chen, 2014; Tadmor, Galinsky, & Maddux, 2012). It was also found that living abroad had a positive association with creative performance in individual problem solving and dyadic negotiation tasks (Maddux & Galinsky, 2009); and foreign work experience was correlated with creative innovations (Godart et al., 2015). Similarly, Aytug et al. (2018) found that multicultural interactions were associated with enhanced creative thinking.

Based on the creative cognition approach, we hypothesize that negotiation dyad's level of previous multicultural experience will be positively associated with their negotiation results, namely, objective (economic) negotiation outcomes (Hypothesis 1A) and subjective (satisfaction-related) negotiation outcomes (Hypothesis 1B)

Perspective #2: Socialization and Perspective Taking Approach

Engaging in cross-cultural activities and social interactions result in a certain degree of empathy, positive emotions and open mindedness towards different perspectives and opinions (Molinsky, 2007; Trommsdorff, & Cole, 2011; Tsai, Miao, Seppala, Fung, & Yeung, 2007). As people socialize with those from different cultures, they become exposed to different preferences and ways of behaving. Over time, this may lead to increased levels of perspective taking, reduced insistence that one's own perspective is always right, and decreased levels of competition regarding getting things their way (Dolan & Kawamura, 2015, Leung & Chiu, 2008; Rogoff, 2003;). Based on this socialization and perspective taking approach, as people develop multicultural experiences, they can become more open to different ideas and more compromising in negotiations due to increased ability to see things from the other side's perspective. Individuals with multicultural experience, may develop increasing levels of comfort, positive perceptions and positive affect about different cultures (Aytug et al. 2018b). Previous positive and friendly social interactions experienced

in one own's personal sphere may actually be reflected in other negotiations in the form of positive affect, perspective taking, and compromising during the negotiation dialogue (Carnevale and Isen 1986; Forgas 1998; Krameret al. 1993; O'Quin and Aronoff 1981).

Research showed that individuals with high positive affectivity are more likely to see others in a positive light and seek out and enjoy social interaction (George, Jones, & Gonzalez, 1998). However, in negotiations, this tendency may reduce the possibility of better and more creative dyadic discussions and negotiation outcomes. Based on this socialization and perspective taking approach, we hypothesize that negotiators' level of previous multicultural experience will be negatively associated with the objective (Hypothesis 2a) and subjective (Hypothesis 2b) negotiation outcomes.

Potential Mediators: Information Exchange and Perspective Taking in Negotiations

Based on the creative cognition approach, individuals who are highly exposed to different cultures become intellectually open, curious, and attentive to people around them (c.f. Leary & Hoyle, 2009). Consequently, individuals with high levels of multicultural experiences may partake in high levels of information exchange and executive functioning during negotiations: They may engage in more exploring, questioning and information exchange to learn more about the other party. In the negotiation context, information exchange is crucial, because it is well-established that the higher the information exchange the higher the joint gain and/or profits in negotiations (c.f. the highly-cited studies: Thompson, 1991; Thompson & Hastie, 1990). When parties communicate efficiently and provide or seek information, joint outcomes increase greatly. This results in mutually beneficial negotiation outcomes that incorporate both parties' needs and interests that will also exhibit creative thinking. Please note, however, that information exchange is a collaborative problem-solving process and is not simply socializing or chatting in a friendly matter.

Consequently, we hypothesize that, level of information exchange will mediate the relationship between negotiation dyad's level of previous multicultural experience and objective (Hypothesis 3a) and subjective (Hypothesis 3b) negotiation outcomes. Individuals with multicultural experience become open to different approaches, perspectives, and opinions which leads to open-mindedness and developed skills of understanding situations and events from others' perspectives. Thus, individuals with higher level of multicultural experience would exhibit higher levels of perspective taking (Rogoff, 2003; Todd, Hanko, Galinsky, & Mussweiler, 2011; Wertsch, 1984). In addition, a dyad's level of perspective taking may influence negotiation outcomes. When negotiators understand a negotiation situation from others' perspective and empathize with the opposite party, then their negotiation behaviors such as compromising and making concession, can impact final negotiation agreements and outcomes (Cheung, Yiu, & Yeung, 2006; Drunckman 1994; Larrick and Boles, 1995; Thompson et al. 2010).

Consequently, we hypothesize that, level of information exchange will mediate the relationship between negotiation dyad's level of previous multicultural experience and objective (Hypothesis 4a) and subjective (Hypothesis 4b) negotiation outcomes.

Methods

Participants

Sixty-five students were recruited from the College of Business at California State Polytechnic University, Pomona. A five-point extra credit research opportunity was given to students who participated in the study. After the elimination of participants who did not provide complete information, the final sample size was twenty-five dyads, i.e. fifty individuals.

Procedure

The complete procedure took about 75 minutes. First an activity packet with all necessary documents was handed to each dyad. Participants had 10 minutes to read their negotiation materials and prepare for the negotiation. The negotiation was about a bakery chef and an entrepreneur trying to come to an agreement about setting up a bakery-café business. There were four negotiation issues to be discussed. Each participant was provided with a payoff schedule for the issues and the possible options to help them understand their priorities and preferences in this negotiation. Participants were not allowed to show their confidential materials and payoff schedule to their negotiation partner. Following the preparation, each dyad had about 30 minutes to negotiate. After the negotiation, dyads reported whether they reached an agreement and if so, what the agreement terms were. Afterwards, individuals answered some post-negotiation questions and filled out an online post-negotiation survey on Qualtrics. The questions consisted of scales and questions about information sharing, negotiation behaviors and satisfaction, their previous multicultural exposures and interactions, and demographic information, i.e. national culture, work status, and gender.

Individual-level data were aggregated to create dyadic level data; both individual and dyad level data were used to run correlation and regression analyses in SPSS. .

Measures

Multicultural interaction level: Participants' level of previous multicultural interactions were measured via the Multicultural Experience Assessment (MExA; Aytug Kern, & Dilchert, 2016). Sample items asked the respondents about their previous experiences of talking to people from different cultures, (e.g., "How frequently do you socialize with people from different cultures and "How frequently do you communicate via writing (e.g., emails, text messages, instant messaging) with people from different cultures?" using a 6-point Likert scale, where 1 = multiple times a day and 6 = never. Dyadic level of multicultural experience was the sum of each party's score.

Information exchange: Following the negotiation, each participant worked individually on a blank payoff schedule form and tried to guess the payoff schedule of their negotiation partner. Since the students did not see their partner's payoff schedule, they could only use the information they exchanged during the negotiation to guess/estimate the payoff schedule of their partner. The accuracy of their guesses was used as a measure of the

level of information sharing within the dyad during the negotiation (e.g "how much did they become aware of your preferences and priorities?" and "how much did you become aware of their preferences and priorities?"). The accuracy level was measured by using a 5-point Likert scale, where 1 = not at all and 5 = a great deal. The average accuracy of the partners was used as a measure of the level of information exchange by the dyad.

Perspective-taking: Perspective-taking, i.e. individual's ability to consider the other party's approach, opinions and preferences, was measured via Perspective-Taking Scale (Davis, 1983; sample item: "Before criticizing somebody, I try to imagine how I would feel if I were in their place.")

Objective negotiation outcomes: Economic or objective negotiation outcomes were measured by adding the payoff points for each party based on the reported agreement and then taking their sum to calculate the dyadic objective outcome.

Subjective negotiation outcomes: The Subjective Value Inventory (SVI; Curhan, Elfenbein, & Xu, 2006) was used to measure the participants' satisfaction with the negotiation's objective outcome (e.g., "How satisfied are you with the negotiation process?"), self image (e.g., "Did you "lose face," that is, damage your sense of pride, in the negotiation?"), negotiation process (e.g., "Do you feel your counterpart listened to your concerns?), and negotiators' relationship (e.g., "Did the negotiation make you trust your counterpart?" using a 5-point Likert scale, where 1 = a great deal, and 5 = not at all. Negotiation partners' SVI scores were summed up to calculate the dyadic subjective outcome.

Results

Participants were 61% male and 39% female. Fifty-eight percent worked part-time, 34 % did not work, and 8% worked full time. Forty-two percent of the participants did not have previous negotiation experience, while 32% engaged in a few negotiations before, 18% negotiated many times, and 8% negotiated frequently and regularly.

Table 1 shows the correlations among the measures. Findings showed that a dyad's level of multicultural interaction has a significantly negative correlation with their objective negotiation outcome (r = -.47, p = .037) and a significantly negative correlation with their subjective negotiation outcome (r = -.42, p = .045). This finding provides early support for Hypotheses 2A and 2B (i.e. socialization and perspective taking approach), refuting Hypothesis 1A and 1B (i.e. creative cognition approach).

Table 1: Pearson correlations among the measures

	α	M	SD	1	2	3	4	5
1. Multicultural interaction	.90	0.01	0.37	1				
2. Dyads' objective outcomes	n/a.	371.50	34.33	-.47*	1			
3. Dyads' subjective outcomes	.84	3.20	0.47	-.42*	-.09	1		
4. Dyadic information exchange	n/a	10.36	2.34	-.11	.56	-.18	1	
5. Dyadic perspective-taking	.75	2.65	0.65	.47*	-.37	-.50*	-.19	1

Note. * $p < .05$ † $p < .10$

Table 2 exhibits the linear regression results. These findings reveal that dyad's multicultural interaction level significantly predicts the negotiation's objective and subjective outcomes and that the higher the multicultural experience the lower the dyad's economic and satisfaction outcomes. As can be seen from the negative Betas, the higher the multicultural interaction levels the worse were the negotiation results, both objective and subjective. Again, these findings support Hypotheses 2A and 2B, not Hypotheses 1A and 1B.

Table 2: Linear regression results

	Y: Objective Outcome				Y: Subjective Outcome			
	β	St. Error	t	p	β	St. Error	t	p
Multicultural interaction	-42.09	18.67	-2.25	.037	-.533	.25	-2.13	.045
Model:	F = 5.08 (df = 1, p = .037)				F = 4.53 (df = 1, p = .045)			

Hypotheses 3A-B and 4A-B argued that the association between multicultural experience and negotiation outcomes may be explained by multicultural experience's role on dyad's information exchange (3A-B) or perspective taking (4A-B) in the negotiation. Next, mediation analyses were conducted via PROCESS on SPSS to see whether level of information exchange or dyad's perspective-taking mediated this negative relationship between multicultural interactions and negotiation outcomes. Tables 3 and 4 exhibit the PROCESS outputs.

Table 3: Mediation analyses for "information exchange" as a mediator

Dependent variable: Objective negotiation outcome (Hypothesis 3A)

```
**********************************************************************
OUTCOME VARIABLE:
 DyadInfo

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .2256      .0509     6.1613     .5361    1.0000   10.0000      .4809

Model
            coeff        se         t         p       LLCI      ULCI
constant   10.0144      .7227   13.8568     .0000     8.4037   11.6251
DyadMI     -1.3612     1.8590    -.7322     .4809    -5.5045    2.7821

**********************************************************************
OUTCOME VARIABLE:
 JointGAI

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .6801      .4625   923.0516    3.8724    2.0000    9.0000      .0612

Model
            coeff        se         t         p       LLCI      ULCI
constant  290.5911    39.7581    7.3090     .0000   200.6208  380.5615
DyadMI    -36.4900    23.3561   -1.5623     .1526   -89.3436   16.3636
DyadInfo    7.3201     3.8706    1.8912     .0912    -1.4388   16.0790
```

Dependent variable: Subjective negotiation outcome (Hypothesis 3B)

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**********************************************************************
OUTCOME VARIABLE:
 DyadInfo

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .1097      .0120     5.8631     .1462    1.0000   12.0000      .7089

Model
            coeff        se         t         p       LLCI      ULCI
constant   10.3559      .6472   16.0024     .0000     8.9457   11.7662
DyadMI      -.6570     1.7185    -.3823     .7089    -4.4019    3.0879

**********************************************************************
OUTCOME VARIABLE:
 DyadSVI

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .6269      .3931      .2297    3.5618    2.0000   11.0000      .0642

Model
            coeff        se         t         p       LLCI      ULCI
constant    3.7535      .6055    6.1994     .0001     2.4206    5.0864
DyadMI       -.8768      .3422   -2.5621     .0264    -1.6302    -.1234
DyadInfo     -.0585      .0571   -1.0245     .3276     -.1843     .0673
```

The mediation models for information exchange were not significant for either dependent variable, objective outcomes (p = .48) or subjective outcomes (p = .71), showing that dyad's level of information exchange does not mediate the relationship between multicultural experience and negotiation outcomes. Thus, Hypotheses 3A and 3B were not supported.

Table 4: Mediation analyses for "perspective-taking" as a mediator.

Dependent variable: Objective negotiation outcome (Hypothesis 4A)

```
**********************************************************************
OUTCOME VARIABLE:
 DyadPers

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .5229      .2735      .2187    6.7755    1.0000   18.0000      .0180

Model
            coeff        se         t         p       LLCI      ULCI
constant    2.5930      .1049   24.7193     .0000     2.3726    2.8134
DyadMI       .7297      .2803    2.6038     .0180      .1407    1.3187

**********************************************************************
OUTCOME VARIABLE:
 JointGAI

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .4904      .2405  1001.0420    2.6908    2.0000   17.0000      .0965

Model
            coeff        se         t         p       LLCI      ULCI
constant  398.1683    41.9543    9.4905     .0000   309.6453  486.6914
DyadMI    -34.2395    22.2514   -1.5388     .1423   -81.1896   12.7107
DyadPers  -10.7649    15.9466    -.6751     .5087   -44.4120   22.8822
```

Dependent variable: Subjective negotiation outcome (Hypothesis 4B)

```
**********************************************************************
OUTCOME VARIABLE:
 DyadPers

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .4660      .2172      .3444    5.8266    1.0000   21.0000      .0250

Model
            coeff        se         t         p       LLCI      ULCI
constant    2.6414      .1224   21.5734     .0000     2.3868    2.8961
DyadMI       .8088      .3351    2.4138     .0250      .1119    1.5056

**********************************************************************
OUTCOME VARIABLE:
 DyadSVI

Model Summary
      R        R-sq       MSE         F       df1       df2         p
   .5402      .2918      .1741    4.1211    2.0000   20.0000      .0317

Model
            coeff        se         t         p       LLCI      ULCI
constant    3.0383      .4190    9.3998     .0000     3.0642    4.8123
DyadMI       -.3079      .2693   -1.1436     .2663     -.8696     .2538
DyadPers     -.2788      .1552   -1.7969     .0875     -.6025     .0449
```

The mediation models for information exchange were not significant for either dependent variable, objective outcomes (p = .48) or subjective outcomes (p = .71), showing that dyad's level of information exchange does not mediate the relationship between multicultural experience and negotiation outcomes. Thus, Hypotheses 3A and 3B were not supported.

Table 4: Mediation analyses for "perspective-taking" as a mediator.

Dependent variable: Objective negotiation outcome (Hypothesis 4A)

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
OUTCOME VARIABLE:
 DyadPers

Model Summary
        R        R-sq        MSE          F         df1        df2          p
     .5229      .2735       .2187      6.7755     1.0000     18.0000      .0180

Model
              coeff         se           t          p         LLCI        ULCI
constant     2.5930       .1049      24.7193      .0000      2.3726      2.8134
DyadMI        .7297       .2803       2.6038      .0180       .1407      1.3187

**********************************************************************
OUTCOME VARIABLE:
 JointGAI

Model Summary
        R        R-sq        MSE          F         df1        df2          p
     .4984      .2485    1001.0420      2.6908     2.0000     17.0000      .0965

Model
              coeff         se           t          p         LLCI        ULCI
constant   398.1683     41.9543       9.4985      .0000    389.6453    486.6914
DyadMI     -34.2395     22.2514      -1.5388      .1423    -81.1896     12.7107
DyadPers   -10.7649     15.9466       -.6751      .5887    -44.4120     22.8822
```

Dependent variable: Subjective negotiation outcome (Hypothesis 4B)

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
OUTCOME VARIABLE:
 DyadPers

Model Summary
        R        R-sq        MSE          F         df1        df2          p
     .4660      .2172       .3444      5.8266     1.0000     21.0000      .0250

Model
              coeff         se           t          p         LLCI        ULCI
constant     2.6414       .1224      21.5734      .0000      2.3868      2.8961
DyadMI        .8088       .3351       2.4138      .0250       .1119      1.5056

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
OUTCOME VARIABLE:
 DyadSVI

Model Summary
        R        R-sq        MSE          F         df1        df2          p
     .5402      .2918       .1741      4.1211     2.0000     20.0000      .0317

Model
              coeff         se           t          p         LLCI        ULCI
constant     3.0383       .4190       9.3998      .0000      3.0642      4.8123
DyadMI       -.3079       .2693      -1.1436      .2663      -.8696       .2538
DyadPers     -.2788       .1552      -1.7969      .0875      -.6025       .0449
```

The mediation models for perspective taking were significant, for both dependent variables, objective outcomes (p < .10) and subjective outcomes (p < .05). In both models, multicultural experience lost its significance when perspective taking was entered as a mediator. Perspective taking was not significant in the objective outcomes model, suggesting partial mediation (partial support for Hypothesis 4A); and it was significant at .10 level in the subjective outcomes model, suggesting full mediation (supporting Hypothesis 4B).

Please note that although p values between .05 and .10 do not provide impressive levels of significance, given the extremely small size of this study (i.e. 20-22 dyads based on the statistical analysis), significance < .10 is treated here as a meaningful significance value. Therefore, we interpret that these results partially support Hypotheses 4A and fully support 4B.

Discussion and Future Direction

The current research explored the relationship between negotiators' previous multicultural experiences and their negotiation performance. Overall findings show that the level of previous multicultural interactions was associated with decreased objective/economic and subjective/satisfaction-related outcomes in a business negotiation. This shows support for the socialization and perspective-taking approach to multicultural experiences within the negotiation context. Positive biases, perspective-taking and over-empathy seem to be a distraction away from information sharing about negotiation issues and discussions, reducing both economic negotiation outcomes and their dyad's satisfaction with the overall negotiation.

Empirical studies have supported the link between multiculturalism and increased productivity and performance. However, this study was the first to investigate the role of negotiators' multicultural interaction levels in negotiations with a close eye on the level of information sharing and perspective-taking. There is only one study that explored the experience of living abroad and this study only focused on negotiation contingencies, and not on economic or subjective negotiation outcomes (Maddux & Galinksy, 2009). Individuals who have been exposed to different cultural experiences enhanced cultural learning and develop higher levels of emotional and cultural intelligence (Crowne, 2013). Therefore, they understand what is socially and culturally acceptable when engaging with someone of a different culture. In the negotiation process then, someone who has high multicultural exposure and high cultural and emotional intelligence possess the capability to understand people and their emotions better compared to individuals who do not. Overtime, these individuals may develop higher levels of openness and acceptance towards different perspectives and opinions, higher levels of perspective taking, and higher tendency to show empathy and acceptance towards differing requests or preferences, possibly causing compromising and concession behavior in negotiations. Therefore, it seems that high levels of multicultural experience may end up causing over-acceptance, reduced questioning, and lower economic results. When the process does not result in good economic outcomes, it may be reasonable to expect that the negotiators will not be very happy about and satisfied with their negotiation either.

In future studies, the relationship between previous negotiators' multicultural experience and individual differences (e.g. negotiation style, attitude, and personality) within a cross-cultural negotiation context may be further explored. It is crucial in today's global and interconnected society that we identify more constructive ways to utilize our multicultural experience in negotiation and conflict dialogues and increase our chances of creating win-win (not compromising) economic results.

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Approach Coping is Associated with Higher Flourishing and PostTraumatic Growth during the lockdown of the Covid-19 pandemic

Abstract

The Covid-19 outbreak changed life for many people with physical distancing, the stress of becoming ill, unprecedented closures, and transitions to online classes and work from home (UNESCO, 2020). Students in particular were challenged with a shift to online settings, which radically changed learning and social interactions. Little is scientifically known about students initially coped (Folkman, 1984; Folkman & Lazarus, 1988) during the pandemic. The current study investigated how four types of coping (approach, avoid, humor, and religion) affected students' flourishing and posttraumatic growth (positive life changes) during the lockdown (April 25-May 8th, 2020) in Southern California. In line with the coping literature (Gustems-Carnicer & Calderon, 2013), we predicted that approach coping would be associated with better student outcomes. Students (N=257) from a Hispanic-Serving Institution in Southern California were recruited via the psychology subject pool to complete an online survey with the brief coping measure (Carver, 1997), Flourishing (Diener & Biwas-Diener, 2009), PostTraumatic Growth Inventory (relating to others subscale, Tedeschi & Calhoun, 1996). Two separate multiple regression analyses showed that the four different coping styles significantly predicted flourishing and PTGI. In line with expectations, results indicated that approach coping was associated with higher flourishing and avoidant coping was associated with lower flourishing. Results also revealed that approach coping was associated with more PTGI and humor coping was associated with less PTGI. These results underline the positive mental health benefits of employing approach coping to support well-being and help spur positive life changes during difficult times.

Intro and Background Research

The Covid-19 pandemic dramatically changed the lives of countless individuals. This situation has instilled the world with fear, stress, and loneliness. These challenges have uniquely manifested themselves in student populations. As a result of the transition to online classes, students have been challenged to juggle the stressors of the pandemic on top of their already stressful lives. Many coping behaviors such as approach coping have been supported to facilitate positive psychological outcomes in students; however, there is limited research that looks at students' coping behaviors within the context of the Covid-19 pandemic. It is necessary to understand coping behaviors and their outcomes during this unprecedented situation because of the new and unique challenges students are facing. This research informs future efforts to facilitate specific behaviors to increase the psychological health of students in many lonely and stressful situations like the Covid-19 pandemic. The purpose of the current study is to do this by analyzing the relationships between college students' coping behaviors and positive psychological outcomes.

Past research shows that the coping strategies of interest have been supported to predict multiple positive outcomes. A few of these strategies, most namely approach, humor, and religious coping, have been shown to predict stable positive affect, positive personality traits, well-being, and posttraumatic growth. Much of this research shows implications that these coping behaviors are very effective for coping with stress, trauma, and adversity.

There is strong evidence for the effectiveness of approach coping on positive psychological outcomes. Gustems-Carnicer & Calderon (2013) focused on how undergraduate students' coping strategies related to their psychological well-being. They found that approach coping is related to more psychological well-being while avoidant coping is related to more psychological distress. Umucu & Lee (2020) examined coping behaviors related to COVID-19 in participants with self-reported disabilities and chronic conditions. They found that participant engagement in approach coping strategies as well as humor and religion was related to participant well-being.

There is also more evidence that shows that humor coping can be an effective coping mechanism for stress and adversity by promoting well-being. Manning-Jones et al. (2016) found that humorous coping strategies predicted more posttraumatic growth among healthcare workers. Schroevers & Teo (2008) also found that humor coping as well as social support predicted more posttraumatic growth when studying Malaysian cancer patients.

Religious coping strategies are also strongly supported by much of the literature as effective behaviors for promoting positive psychological health. Bosson et al. (2012) studied religious coping in adult mothers living in New Orleans during Hurricane Katrina, and they found that positive religious coping had a significant relationship with posttraumatic growth and this relationship was mediated through deliberate rumination. De Castella & Simmonds (2013) also show that religious coping and framework influences posttraumatic growth. They claim that this happens because religious coping may provide meaning, social support, acceptance, and integration of life events.

In order to analyze the relationship between coping and positive psychological outcomes, subjects in the current study answered a series of survey questions that captured their approach, avoidant, humor, and religious coping behaviors as well as their perceived flourishing and posttraumatic growth. It was predicted that approach coping would be associated with higher flourishing and higher posttraumatic growth. It was also predicted that humor and religious coping would be associated with higher posttraumatic growth and higher flourishing. Another prediction was that avoidant coping would be related to lower flourishing and lower posttraumatic growth.

Methods

Participants

Participants were self-selected via a convenience sample of students enrolled in psychology courses at a large Hispanic-serving institution. They were recruited via SONA systems, a research participation database where participants receive the choice to select from a list of active studies. There were a total of 110 participants, of whom 72% were females. The majority of participants (63%) identified as Hispanic/Latinx, and the average age of the participants was 22 years old. Participants were compensated for their time by receiving SONA credits.

Materials

After using SONA to self-select to participate in the study, participants were given a link to complete the survey via Qualtrics, an online survey tool that allows one to create and distribute surveys. In order to more accurately measure the variables of interest, multiple scales with documented psychometric properties were included in the survey. These scales measured the use of many coping behaviors as well as positive outcomes such as well-being and posttraumatic growth.

To measure coping, the Brief COPE scale was included in the survey(Carver, 1997). These items measured the frequency of various coping behaviors such as approach coping, avoidant coping, humor coping, and religious coping. Several subscales are present in the Brief COPE. Approach coping includes the subscales of active coping, positive reframing, planning, acceptance, seeking emotional support, and seeking informational support while Avoidant coping includes the subscales of denial, substance use, venting, behavioural disengagement, self-distraction, and self-blame. Humor and religious coping are also included in the Brief COPE scale, but they are separate from Approach and Avoidant coping. Participants responded to these items in a four-point Likert-type scale ranging from I haven't been doing this at all to I've been doing this a lot. Higher scores indicated a more frequent use of a given coping behavior, and the Cronbach coefficient on this scale was 0.824.

To measure well-being, the Flourishing Scale was included in the survey (Diener et al., 2009). This 8-item Likert-type scale measured psychological well-being by capturing the self-perceived success in many important areas of one's life (Diener et al., 2009). The 7 response options ranged from strongly disagree to strongly agree where higher scores indicated more agreement. The Cronbach coefficient on this item was 0.934.

Another scale that was used to measure well-being was the PostTraumatic Growth Inventory (relating to others subscale, Tedeschi & Calhoun, 1996). This scale measures well-being by capturing the positive change that one experiences in relation to a traumatic or stressful experience. This is another Likert-type scale with 5 response options ranging from I did not experience this change to I experienced this change to a great degree. Higher scores indicated more posttraumatic growth, and the Cronbach coefficient on this item was 0.893.

Procedure

SONA was used to distribute the Qualtrics survey to the participants. On SONA, potential participants chose from a list of studies to participate in. Prior to selecting a given study, participants have access to a brief description of each active study as well as the amount of SONA credits they would receive for participating in a given study. After committing to participate in the current study, participants received the Qualtrics link to participate in the study. Participants were informed on the potential risks of participating and asked if they consented to participate. After providing their informed consent, and confirming CPP student enrollment, participants answered a series of questions that were designed to assess the target variables. After completing the survey, participants were compensated with SONA credits that may have transferred as class credit at their psychology instructor's discretion.

Results

A total of 257 students were included in the analyses. Thirty-one participants were not included in the analyses because they failed to answer a majority of the questions on the survey. Two more participants were not included because they were researchers on the current study.

Guided by the coping literature, we hypothesized that students participants engaging in more approach coping behaviors would report higher levels of well-being such as higher posttraumatic growth and flourishing while participants engaging in more avoidant coping behaviors would report lower levels of well-being. To test these hypotheses, we conducted two separate multiple regression analyses.

The four different coping styles significantly predicted flourishing ($R^2 = .28$, R^2 adj=.26, $F(4, 253)=23.97$, $p<.001$) and PTGI ($R^2 = .15$, R^2 adj=.14, $F(4, 253)=11.05$, $p<.001$. In line with expectations, results indicated that approach coping was associated with higher flourishing ($\beta= .45$, $t(253) = 7.71$, $p<.001$) and avoidant coping was associated with lower flourishing ($\beta= -.27$, $t(253) = -4.75$, $p<.001$). Results also revealed that approach coping was associated with more PTGI ($\beta= .38$, $t(253) = 5.93$, $p<.001$) and humor coping was associated with less PTGI ($\beta= -.13$, $t(253) = -2.06$, $p<.001$).

Discussion

The results are consistent with previous literature, and they support the original hypothesis that approach coping is related to more psychological well-being while avoidant coping is related to less well-being. This relationship implies that students who engage in more approach coping behaviors during the COVID-19 pandemic will experience more positive changes and outcomes. These results spotlight the positive mental health benefits of engaging in approach coping to facilitate well-being and help spur positive life changes during difficult times. These findings may also act as a guide for future efforts to facilitate well-being and positive changes during many more stressful and isolating situations unrelated to the current pandemic.

The finding that humor coping is related to less posttraumatic growth was surprising and inconsistent with previous literature. One possible explanation for this finding has to do with the timing of the study. The data was collected during the beginning of the transition to virtual instruction, and some past research suggests that the chronological distance of a tragedy influences the humorous responses to that tragedy (McGraw et al., 2014). Another possible explanation for this finding is that students who are engaging in more humor coping are not taking the pandemic seriously or are even using humor as a way to escape reality. This type of avoidance may influence participants to undervalue the importance of positive change during this stressful and unprecedented situation.

Acknowledging this relationship between approach coping and posttraumatic growth as well as flourishing is important for many reasons. This relationship exemplifies the positive mental health benefits of the use of approach coping to facilitate well-being and employ positive psychological change during stressful and difficult times like the Covid-19 pandemic. Researchers, clinicians, and educators should keep these results in mind in order to help students push through difficult times by teaching them the skills they need to be better equipped to deal with the inevitable challenges they will face.

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Investigating the Role of FcγRIIa on Neutrophil Ability to perform Trogocytosis on Trichomonas vaginalis

Abstract

Trichomoniasis is a sexually transmitted infection (STI) caused by a protozoan pathogen named Trichomonas vaginalis (Tv). Tv affects more than 300 million men and women worldwide. A literature review showed 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. Opsonization by antibodies was shown to be important 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 important 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 will generate CD32a knockout neutrophil-like cells (NLCs) and perform several assays that will show whether trogocytosis was affected by that CD32a knock out. We have already created a plasmid that will mediate CD32a knockout, and 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 Fc- receptor . We hope that by the end next semester we will have successfully transfected the CD32a knockout sequence into the precursor cells, differentiated the cells into NLCs, and performed assays that will determine trogocytosis activity.

Introduction

Trichomonas vaginalis (Tv) is a protozoan parasite that causes a sexually transmitted infection (STI) called Trichomonaisis in humans. The World Health Organization reports over 300 million infections worldwide [1,2]. Although there is a high number of trichomoniasis infections reported, there are also cases in which the infection is asymptomatic [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 have been shown to be most affected by trichomoniasis [4]. Even though Tv is treatable with antibiotics such has metronidazole and tinidazole, there has been an increase in Tv-strains 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 also affects infants of infected mothers causing low-birth weights and premature births [5,8].

The immune response to Tv includes the influx of neutrophils to the area of infection where they attack Tv [10,11]. Neutrophils have 3 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 by using Fc-Receptor-blocking antibodies. In the study, many surface Fc receptors were blocked using Fc-receptor blocking antibodies that interact with the Fc-receptor on the neutrophil. When the Fc-Receptors are interacting with the blocking antibodies, the receptors on the neutrophil wont interact with the antibodies against the cancer cell.[13]. The experiment showed that neutrophil trogocytosis was reduced in the presence of antibodies that block Fc-receptors [13]. This led us to hypothesize that Fc -receptors may also be important for the killing of Tv. FcγRIIa (CD32a) is a surface Fc-receptor that showed a significant decrease in neutrophil trogocytosis of cancer cells when blocked [13]. 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.

Studies have shown that neutrophils utilize trogocytosis for killing Tv [12]. Opsonization by antibodies is important for neutrophils to kill Tv [12]. CD32a is a neutrophil cell-surface receptor shown to be important for the trogocytosis of cancer cells [13]. We hypothesize that CD32a also has an important role in the initiation of neutrophil trogocytosis on Tv.

Major Objectives

Although the exact immunological mechanisms the body uses to clear a Tv infection have yet to be established, studies have shown that trogocytosis is the method neutrophils use to kill Tv. Trogocytosis is a process in which cells, such as neutrophils, take "nibbles "of a pathogen until the pathogen is killed. It has been shown that the blocking of CD32a has a significant impact on neutrophil ability to perform trogocytosis to kill cancer cells. We hypothesize that knocking-out the CD32a gene will decrease the ability of neutrophils to use trogocytosis to kill Tv.

Understanding the role of CD32a in the initiation of trogocytosis on Tv can provide more information on specific players in the mechanism of trogocytosis of Tv. We hope that our findings can help to inform the design of prevention treatments for Trichomonaisis, such as vaccination. The goal of my project is to determine whether the neutrophil cell surface receptor CD32a plays a role in trogocytosis of Tv.

Approach

Generating Neutrophil-like Cells

In order to determine if CD32a is important for trogocytosis of Tv, we will knock out CD32a from neutrophil-like-cells (NLCs) and use assays to test the NLC's ability to trogocytose Tv. Because the lifespan of neutrophils in vitro is very short, making it difficult to perform experiments with the neutrophils, we will instead use NLCs, which are derived from the precursor cells to neutrophils, called promyelocytic cells [15]. There are two different types of promyelocytic cell lines we can use, HL-60 and PLB 985, both of which differentiate into NLCs in vitro [15]. The reagents we will use to differentiate the promyelocytic cells into NLCs are 1.3% DMSO and 100 ng/ml of C-GSF. These reagents have been shown to drive promyelocytic cells to differentiate into NLCs [15]. Nutridoma is a novel differentiation reagent we used use to try to differentiate cells, because it has recently been shown to enhance the phagocytic properties of NLCs [15]. We will use promyelocytic cells for transfection and differentiate the promyelocytic cells with the CD32a knockout to NLCs. Differentiated NLCs with the CD32a knock out will then be used to test for trogocytosis with a series of different assays [2].

Confirming Expression of CD32 on NLCs

Before knocking out CD32a, we will confirm that CD32a is present on the surface of NLCs. We will perform antibody staining and run NLCs through a flow cytometer to observe whether they fluoresce, indicating binding of the fluorescent CD32 antibody to the NLC surface receptor. Due to the limited amount of CD32a specific antibodies on the market, we chose to use an antibody against CD32, which binds to CD32a, CD32b, and CD32c. However, we found that CD32a has significantly higher expression than CD32b or CD32c [16]. CD32b is an inhibiting receptor and CD32c is also an activating receptor, but is not expressed as highly as CD32 [16]. We can predict that CD32 and CD32a antibodies will provide similar results because it has been shown that CD32b detection ranges from low to undetectable [16].

Generating the Knock-out Plasmid

The way that we will knock out the CD32a gene, is by using the CRISPR/Cas9 system. To use the CRISPR/Cas9 system, we will choose a sequence, also known as an oligo, and create a guide RNA template that will recognize the chosen complementary sequence. Then the Cas9 enzyme will bind the oligo and cut the sequence [17]. This will result in the knock-out of the expression of the desired gene [17]. The CD32a guide RNA template has been created, and was inserted into a plasmid px459 through ligation. Next, we will grow bacteria containing our px459 containing our oligos so that we are able to extract and purify the plasmid at a higher concentration through maxiprep.

Generating CD32a Knock-out NLCs

After confirming the presence of the CD32a receptor, we will transfect the promyelocytic cells with our plasmid that contains the CD32a guide RNA template oligo and Cas9 enzyme using electroporation. Electroporation is a process in which holes are temporarily made in the promyelocytic cells so that DNA can enter the cells [18]. The way the Cas9 enzyme will work is by making a cut in the target sequence in the gene of the cells by using the guide RNA we designed. [19]. The cell will try to repair the damage to the cells,

using its error-prone NHEJ pathway, hopefully creating a frame-shift mutation [19]. This mutation will disrupt the Ig domains, which are important for CD32a's antibody-binding function. When the transfection process is complete, we will perform antibody staining and measure fluorescence that will indicate CD32a presence. We expect to see little to no fluorescence, indicating that CD32a has been knocked out and is not being expressed in the promyelocytic cells.

Testing Cytolysis Activity of NLC using Fc-Blocking Inhibitors

We have been able to observe the killing of Tv by NLCs using a cytolysis assay. We labeled NLCs using an orange dye, and Tv using a green dye. Both the NLCs and Tv were cocultured together for an hour at different NLC to Tv ratios. After incubation we observed the samples using a flow cytometer. We then analyzed the data using the software FlowJo. We have used this method to further confirm that Fc interactions are important for the killing of Tv [20]. Spleen tyrosine kinase (SYK) has been shown to mediate intracellular signaling by Fc receptors in neutrophils. The inhibitor we will use is called BAY-61-3606. The inhibitor was added to the NLCs and incubated for 30 minutes at 37 °C before we cocultured the NLCs with Tv.

Testing Trogocytic activity of CD32a Knock-out NLCs

After confirming that CD32a has been knocked out of our promyelocytic cells, we will differentiate the precursor cells into NLCs. Differentiation will be done by adding 100ng/ml of G-CSF (allows for cell viability) and 1.3% DMSO (differentiation reagent). We will also test a different reagent for differentiation called Nutridoma by differentiating with 2% Nutridoma and 1.3% DMSO. We will also measure trogocytosis activity and death of Tv. We can test for trogocytosis and Tv death through a trogocytosis assay, and a cytolysis assay, respectively. We predict that we will see little to no trogocytosis activity following CD32a knockout. We will observe and analyze this through florescence microscopy and flow cytometry. Results

This year, we were able to successfully perform antibody staining of the promyelocytic cells and differentiated NLCs. We found that CD32a is present onNLCs. CD32a was expressed higher in the differentiated NLCs than promyelocytic cells. We were also able to perform antibody staining to find which cell line (HL-60 or PLB-985) expresses more CD32. Figures 1A and 1B are histograms that show the CD32 expression on HL-60 (Figure1A) and PLB 985 (1B). The data confirm the presence of CD32 expression on both cell lines. We also show the mean fluorescence intensity (MFI) of triplicate samples (Fig 1c). The data show that there is a higher MFI on PLB 985 cells compared to HL-60 cells. We were able to conclude that PLB-985 cells had a higher expression of CD32 and would therefore be best to use for our experiment.
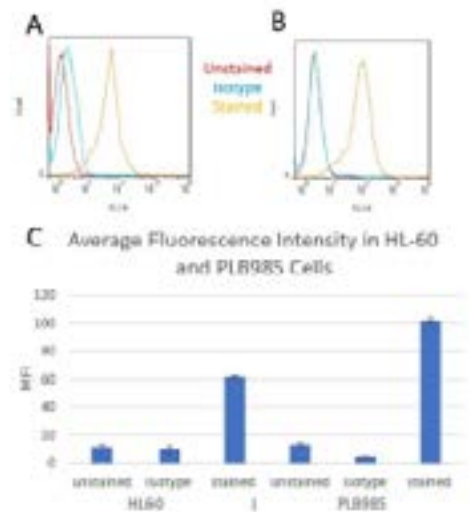
Figure 1 CD32a expression: Figure 1A and 1B are histograms that show the expression of CD32 on (A) HL-60 cells and (B) PLB985 cells. The data shows that the red peak (unstained cells), and the blue peak, (isotype control) were not as intense as the orange peak (CD32 stained cells) in both Figure 1A and 1B. Figure 1C is a bar graph that shows the average mean fluorescence intensity (MFI) in HL-60 and PLB-985 cells. The MFI was most intense in stained cells, with PLB985 cells showing a higher expression of CD32. The standard deviation of our data is represented as error bars.
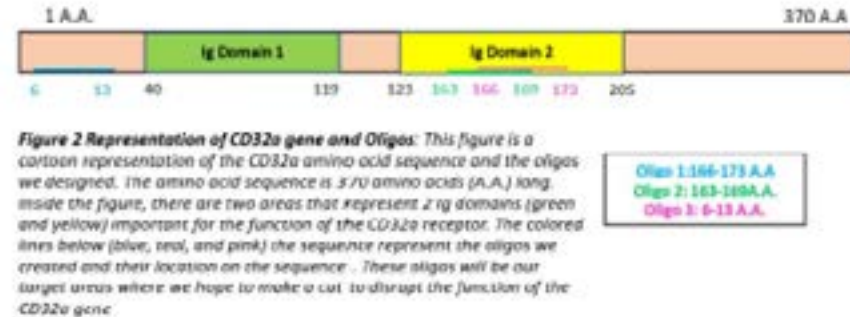
Figure 2 Representation of CD32a gene and Oligos: This figure is a cartoon representation of the CD32a amino acid sequence and the oligos we designed. The amino acid sequence is 370 amino acids (A.A.) long. Inside the figure, there are two areas that represent 2 Ig domains (green and yellow) important for the function of the CD32a receptor. The colored lines below (blue, teal, and pink) the sequence represent the oligos we created and their location on the sequence . These oligos will be our target areas where we hope to make a cut to disrupt the function of the CD32a gene

Having confirmed that CD32 is expressed on NLCs, we then designed our knock-out strategy. Using the NCBI website, we found the two Ig domains in the CD32a gene. The Ig domains are important because they are where CD32a specifically binds to antibodies (insert reference). We then were able to find 3 oligos, using E-CRISP.org, that would be before or within the Ig domains. This is because we want 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. Figure 2 shows the CD32 protein and the location of the two Ig Domains colored in green and yellow. At the bottom of the Ig domains, are lines that represent our oligos and their locations in the CD32a protein oligo 1 and oligo 2 are within Ig domain 2 and oligo 3 is before Ig domain 1. The oligos will serve to create a guide template for the Cas9 enzyme. Once we designed our oligos, we ordered them from a company and then set out to clone them into the px459 plasmid, which contains the Cas9 enzyme. We prepared our px459 plasmid through digestion and purification. Then we inserted our oligos through ligation. We will now test these three oligos individually to see whether they can each knock out CD32a expression, and which one does this most efficiently.
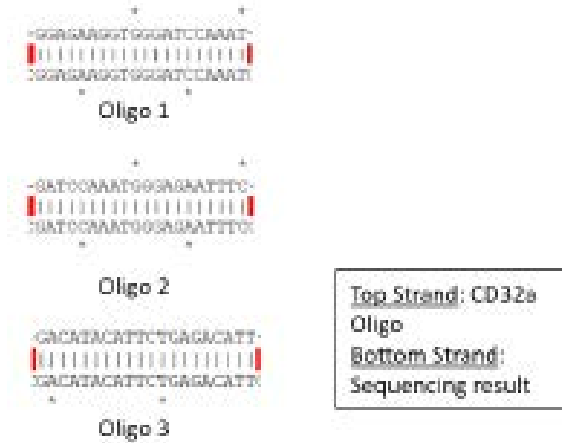

Figure 3 Transformation confirmation : Figure 2 shows the sequences for CD32a oligos 1, 2, and 3 that were extracted from bacterial cells and sent for sequencing. Primer U6 was used to find the 20 base pairs that fit our oligo. The sequences were aligned, using ApE software, with the unique sequences that code for CD32a. The two sequences aligned in all 20 base pairs.
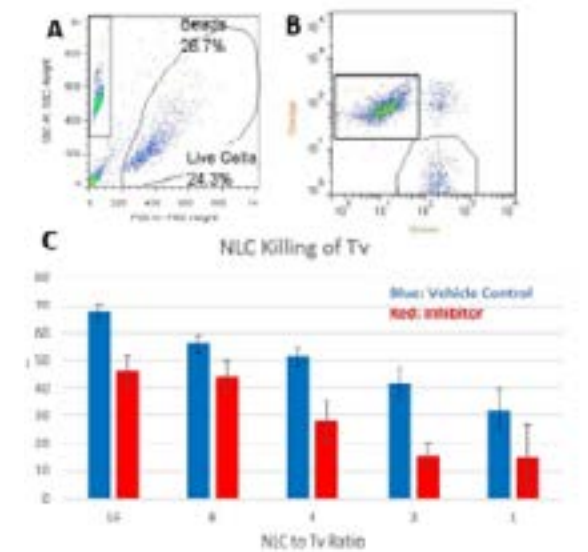

Figure 4: This figure shows the data obtained from a cytolysis assay. Figure 4A shows the percentage of beads (rectangle) and the live cells (circle) found in our sample. 4B shows the live cell populations where the circle gate is representing the population of parasites, and the rectangle represents the population of NLCs. The populations were examined in g orange dye and green dye graph where the orange dye is the y-axis and the green dye is the x-axis. Figure 4C shows the different ratios and comparing the killing between our vehicle control (blue) and the cells that contained the inhibitor (red).

After creating our knockout construct, we inserted the plasmid with our oligos into bacterial cells using transformation, and allowed them to grow up for 1 day. This was done to increase the concentration of our plasmid. We were able to extract the plasmid from the bacterial cells using maxiprep. We now have a concentrated amount of our desired DNA that we can use to transfect the promyelocytic cells. We were able to confirm that our desired plasmid was transformed into the bacterial cells by sending out a sample for each plasmid containing our oligos for sequencing. Using the ApE software, we were able to line up our sequences with the target oligos we designed and were able to confirm that the sequence of each oligo was present in our cells. Figure 3 shows the plasmid DNA aligned with the sequence of CD32a, confirming that oligos were inserted into the plasmid.

We then optimized our cytolysis assay to test for killing of the parasite by NLCs. 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.. We observed the populations of the NLCs and Tv using the flow-cytometer. We created gates around the population of live cells and the population of Tv using software FlowJo to determine the percentage of Tv killed. In Figure 4A, we see the results of a sample from our cytolysis assay. The cells around the gate are the cells that are alive in our sample and the rectangular gate is the gate surrounds the beads. More importantly in Figure 4B, we see 3 different populations. The top left being NLCs, the bottom right is the gated Tv population. The population in between, are double positives. This means that the machine picked up signals for both the orange dye of NLCs and the green dye from Tv. We can say that these double positives may be the NLC population trogocytosing Tv. This is because if a neutrophil is engulfing parts Tv, it will contain part of the cell tracker green dye within or around the cell. We used this method to confirm that Fc receptors play a role in the killing of Tv. We used an inhibitor called BAY-61-3606, which inhibits the downstream signal protein

called SYK. When the protein is inhibited, there will be no signal triggered within the cell, and no trogocytosis activity would occur, therefore inhibiting the Fc-receptor. Figure 4C compares the killing of the different ratios of NLC to Tv as well as 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.

Future Directions

There are a few things left that we hope to complete next semester. First, we will transfect our NLC with our CD32a knock-out plasmid. We will do this through electroporation. After we transfect the cells, we will perform antibody staining to confirm that CD32a, has been in fact knocked out. Finally, we will end by doing trogocytosis and cytolysis assays to observe the trogocytosis activity of NLCs on Tv. We predict to see little to no trogocytosis activity. We also hope to do an add-back experiment where we add the CD32a genes back and examine the process of trogocytosis. This will help us to confirm that CD32a has a significant role in the initiation process of trogocytosis. Learning more about the receptor CD32a will give us more insight on how the immune system uses NLCs to kill Tv and may help create a prevention treatment for Trichomonaisis in the future.

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Phan   **Loot Boxes in Virtual Worlds**
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Abstract

Loot boxes are purchasable items in video games that are consistent with items of randomized rarity. Current studies on loot boxes have only covered the possible effects of loot boxes and habitual gambling. However, this project explores how loot boxes affect virtual economies and player experience. As many games have integrated loot boxes into their core gameplay, loot boxes have also helped establish virtual marketplaces that allow players to sell and purchase items. The purchasable items on these online markets can vary in rarity and are bought by using in-game currency that gamers can eventually work towards. Gamers engage with this virtual economy by grinding, which may be viewed as labor; players can spend hours trying to obtain enough materials to purchase items on the market to become more viable within the game. Without access to rarer materials, players who do not indulge in loot boxes are at a disadvantage, having to play longer and to reach the same levels as people who spend money. Contributing to economic anthropological theories of commodity and gift exchange through virtual ethnography, this paper will look into divisions of statuses among gamers based on the differences in Free to Players versus those who pay for loot boxes.

Major objective

I achieved IRB approval and I was able to move along with research. So far I have almost 20 interviews from volunteers. My objectives for the future are to continue the rate of interviews and to add more focus groups into the mix. This would expand my understanding of loot boxes further by having people from several games talk about their differences in loot boxes and the similarities that loot boxes have shown within multiple different types of games.

Background research with analysis and summary of literature review

Virtual worlds and massively multiplayer online games, also known as MMOs, have become a hub for people worldwide that have seamlessly created cultures in their own right. MMOs bring thousands together to play, compete, and to enjoy one another's company. It was only recently that loot boxes had become an industry standard within video games. Many games have integrated different forms of loot boxes within mobile and popular MMOs, which became extremely controversial due to their invasive and predatory nature of in-game item monetization. However, many loot boxes have become an integral part of online economies where people sell higher rarity items obtained from loot boxes for in-game currency or real-life money. With the monetization of high-value items from loot boxes, free-to-play players to obtain higher rarity items need to play longer in the process of grinding, which may comprise any sort of labor to obtain material. Sometimes grinding involves real money, and sometimes it only involves virtual money (Yee 2016; Kaminski 2006; Boellstorff 2015; Coutu 2015). Though there is a growing body of literature on virtual economies and virtual worlds, there has been a lack of study on how virtual economies affect players of

virtual worlds. This project will examine how players engage with virtual economies using ethnographical methods to observe possible divisions of status among gamers based on the differences of free-to-play players versus those who pay for in-game items. The continuous use of loot boxes in virtual worlds can be harmful for those who do not spend real money for in-game items. If the rest of the player base indulges in microtransactions it only reinforces the idea that players approve of loot boxes, which may eventually lead to a dependency on loot boxes in virtual worlds (Schreier 2017). Overall, dependency on loot boxes detracts from the player experience, by pressuring players to pay for something that is advertised as optional. In turn, this may consequently cast a negative light toward players.

The implementation of loot boxes has been increasingly controversial due to its predatory like monetization of virtual items. Many loot boxes in virtual worlds are for cosmetic use to help customize a player's avatar, which does not significantly impact gaming performance or give an advantage over other players within the world (Hemp 2006; Boellstorff 2015). However, many digital worlds offer loot boxes that contain items that can give players significant advantages, such as higher rarity items that boost abilities. Loot boxes have been promoted by developers because they "enhance or complement the base game," and the reactions to loot boxes have been largely positive (Mistry 2018). However, contrary to the perspectives of developers, many players have seen loot boxes as another additional cost to players who may have already paid for a fully priced game. This thus creates an environment of obligated gambling. For example, when loot boxes were implemented in Guild Wars 2, locked loot boxes freely available for its players, as well on the marketplace loot boxes are sold as extremely cheap. However, to open the box, players require keys (Weber 2018). Because of the disparity of keys, players are forced to purchase keys on the market or farm for keys for weeks or even months to open one box. However, what is also quite detrimental is that Guild Wars 2 placed new weapons that are highly beneficial within loot boxes, making it so those who can pay the money are the ones who can easily advance through the game.

Marketplaces or auction houses provide players with a place to engage in a real-life economy where they would participate in the economies "production, trade, consumption or labor" (Lehdonvirta 2018; Kaminski 2006). Regardless of whether they pay or not, players are required to do some sort of labor. Whether the labor be going to work, running a business or the labor known as grinding in video games (Yamaguchi 2004; Yee 2016; Boellstorff 2015). These forms of grinding are ways to help operate the digital economy and a way to earn money. Grinding is compared to typical labor due to the number of hours people commit to eventually certain currencies or items of value. Though the currency is not physical, virtual currency holds enough intrinsic values that people would buy and sell virtual gold with real money(Yee 2016; Kaminski 2006; Heeks 2009).

Free to Play players are some of the most populous in online worlds if the games do not have a subscription-based service. Many games allow players to be free to play while paying for items with real currency is optional. Having games that are free to play creates a positive attitude, and enhances players' experience since they can try the game without paying (Alha et al., n.d.).However, the game invasively tries to convince the player to pay for microtransactions through various means, such as advertisements, deals, and locking special items behind a paywall. While many free to play players are at a disadvantage, they

are able to grind for the items they need. Free to Play Games also use strategic methods to retain free to play players, often creating a game with a gameplay while also offering a "competitive and social endgame" Free to Play Players are at a clear disadvantage at the game, however, they can earn the items they can but through more extended gameplay (Narinen 2014). This can have a both a positive and negative impact on the player's attitude towards the game, but players who do have social interactions with other players through the game are more invested in the game's culture. On the other hand, considering free to play may feel like a burden since progress for the player is stunted. That is, the player must put in extra effort to be able to reach the end game, and may be denied access to many limited edition items and goods due to a paywall. Free-to-play player retention is critical for a game's success, as they build the bulk of the virtual community by helping to create forums and guides for other players, even if the game leans towards a pay to win type of game.

Loot boxes, as stated previously, are objects of great controversy not only among players but also politicians due to their gamblification of games. The current climate about loot boxes in public media has been perceived as unfavorable, and many countries have tried to regulate microtransactions and loot boxes. Loot boxes and their way of monetization have been accused of being extremely predatory towards players specifically towards children. Many have raised concerns that loot boxes in games may be correlated with problematic gambling (Kim 2016; Li, Mills, and Nower 2019; Zendle 2019; Ball and Fordham, n.d.; BBC 2020; Koeder, Tanaka, and Mitomo 2018). However, the regulations on loot boxes have differed from country to country, depending on how the country understands gambling and the mechanism of loot boxes. Western countries have imposed harsher bans on loot boxes in attempts to regulate gambling addictions toward youth in places such as the United Kingdom, United States, Belgium, and Australia (BBC 2020). Those who argue for loot boxes assert that this policy trend is very detrimental to developing games that are free to play because it inhibits the rise of new games and their potential income (BBC 2020). While many of them still may have microtransactions, loot boxes are a significant source of income for many games, and the removal or lack of company self-regulation could be detrimental to both games and players who do base themselves off loot boxes and virtual economies (Ball and Fordham, n.d.). Unfortunately, because the available literature mainly focuses on the gambling aspects, the economic impacts of how loot boxes affect player status are very unexplored.

Providing an anthropological view on the virtual world's economy and its effects on player status would significantly add to the current gap of literature on virtual worlds. In addition, the research will add another viewpoint to how loot boxes are implemented into games. Ultimately, this research seeks to inform policy solutions to limit the inclusion of loot boxes in future games or incentivize more self-regulation from companies to minimize harmful experiences of players. As many players spend a considerable amount of time in virtual worlds, they have seen a great deal of growth and development in virtual economies and status hierarchy. Expanding on the literature will thus have potential benefits for our real society beyond virtual worlds.

Methods

Participants will be recruited virtually online but, using the help from informants, the PI will also go through the game. The PI will be interviewing the people they meet in the Virtual World as they advance through the game's story/quest line and will be joining social gatherings such as guilds or party quests to get a better insight into how the game affects the players. The PI will be experiencing this game as a free-to-play player meaning the PI will spend the minimum amount of money, which is around 5 dollars per month, to none at all. 5 dollars per month often does not get players much other than a way to catch up to other players slightly; however, 5 dollars a month will barely make a difference to free-to-play players compared to those who do pay-to-win. This is to capture the free-to-play experience and to experience the labor and effort that free-to-play players experience. The PI will have to earn their money through in-game means, including grinding, selling items on the online market, and doing quests within the game. The PI will also be talking players who are both free-to-play and pay-to-win. The PI, when speaking or chatting with the participant, will explain the concept of the research and provide them an oral consent or text consent so that they may provide consent to having their information used during this research. If the player does not consent then the PI will not record or in any form use their information for this research. Pay-to-win players are players who spend a month in their virtual world as a way to gain player benefits or to obtain items of aesthetic value for their character. As the PI plays on the virtual world, they will be observing and will be speaking with the players casually to get to know the locals of the game as well as learning about their experiences with the game. The PI will keep all Virtual Names confidential since their username online is already anonymous. The PI will assist in creating another layer of confidentiality by assigning them a letter-number combo, such as A-01, to continue to protect their identity. The recruitment for the interview will be open to all who participate in the survey or those the PI meet in the virtual world.

The PI will then be interviewing those who she meets in the virtual world and from the participant pool from the survey. Due to the nature of this research and the current pandemic situation, all interviews will be done online. The survey will have consent forms for both consenting individuals, minors, and also guardians of minors. After the survey is completed the participant will be able to choose whether or not they would like to be further contacted to do an interview.

The participant will be given the choice to do the interview via Zoom, Discord, phone or other communication application they feel the most comfortable with. Each interview will be recorded with permission from the participant to be later transcribed. During any part of the research, the participant who no longer wants to be involved with the research will be removed from the study. The participant will also be asked if they would like their information to be kept in the aggregate form; if not all their data will be purged and wiped from the system.

The progress made towards this project was to become more familiar with in the game. The game that I focused on was Maplestory M, where I spend around 4 hours a day trying to level up as much as I can without spending any money These are all from a single player's point of view and captures the experience of what it is like to be a free-to-play

player. What I have discovered is that games such as Maplestory M and other MMOs have developed a system that entraps a player by giving them a false sense of security for quite a while. The security is that they are given everything from the game. In fact, they are given a large amount of time that they probably will not need. This makes the player believe that they do not need to buy any loot boxes because of their overabundance. Once they run out or out level the need to use these items, they start struggling. This struggle makes them more reluctant to quit because they have already invested a lot of time in the game, and they have established that they have invested in the game.

I have completed over 70 logged hours of playing Maplestory M. This includes grinding for indeterminate hours just so I could get enough mesos to purchase cash shop items from the auction house. I was able to afford a roll from their loot box due to the free gems that were given to me for joining. Besides my character hair and the scarf I got from the loot box, I was not able to get a lot of items. Many of the items I have on my character are decent, and I can rank them up without too much trouble. However, finding material sacrifice to upgrade my weapon and scrolls to reset their stats is difficult to come by. By level 130, I started leveling around once every three to six days, comparatively leveling once a day or a day in a half. Premium weapons and stat-boosting items were still unobtainable. I was able to join a guild as well. However, they are not active, and I presumed them a dead guild since no one has ever spoken in the guild chat, nor has anyone been in the guild room. What is not logged or recorded is how many hours and how much time I invested in forums looking up information and data on how to grind efficiently or find items for my character. Once invested in a game after so many hours, and you tend to seek out similar information online and tend to learn as much as you can about the game.

In early May, I received approval from IRB, and I was able to conduct a few interviews. So far, I have completed around 20 interviews, all of them from different virtual worlds as loot boxes are not only contained in MapleStory M but in multiple worlds. I found out that many loot boxes usually operate either the aesthetic category or the advantage category. The most popular game I have been getting interviews from was from Apex Legends developed by Epic Games. Most of their loot boxes are for aesthetic purposes, but since there is a large range of characters, it's hard to get the skin or item they want. Though you get a loot box every few levels, according to players, it is not really enough, and the temptation to buy apex packs are really tempting. Participants also mentioned that they are glad that Epic Games offer a rotation of skins in the shop so that players may buy them without going through loot boxes.

A trend that I found during interviews was also the acknowledgment that loot boxes are basically an industry standard that is gamblifying the gaming industry. Though it sucks, many players already expect a type of microtransaction and even participate in loot boxes if the possible outcome seems worthwhile. One group of players who play Genshin Impact participates in loot boxes due to some character's attractiveness and the benefit that the character is actually good to play. The trend also seems players should expect if they enjoy the game, spend a large amount of money as that's how they are to get better at the game.

IRB approval was so late that I was not able to get so many interviews done. I was in constant contact with Maya, and we worked together to get it approved. Thanks to

Professor Blair, my application went through. I also was able to supplement the data with my autoethnography, which I was able to get a lot of information from my own experience, and I was able to build a repertoire with players on Discord and Reddit.

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**Pierce
Caitlyn**

**Does Time Together and Collegiality Matter on the U.S. Courts
of Appeals?**

Abstract

The U.S. Courts of Appeals assigns three judges to a panel to hear each case.
Depending on the circuit, the method for assigning judges to these panels varies in degree
of randomness. Previous literature suggests that the way judges decide cases changes
based on who the judges hearing the case are, but this scholarship does little to address
how the different methods impact this phenomenon. Therefore, this study is researching if
the different methods of panel assignments affect panel characteristics and judicial decision-
making. This paper argues that the amount of time a judge sits with another judge will
influence the likelihood a judge will agree with the other judges on the panel. This study
specifically evaluates the Ninth and Fourth Circuit courts to test this argument due to the
Ninth Circuit requiring the judges to serve equal amounts of time with other judges and the
Fourth Circuit having the closest system to random assignment. The results find that there
was no statistical significance between the number of times a judge sits with another judge.

Introduction

Judicial decision-making is a vital part of the legal system, but specifically in the
appellate levels of the judicial system. Judges on the U.S. Federal Courts of Appeals
and Justices on the United States Supreme Court (USSC) hear and decide cases in the
absence of juries. This differs from their colleagues in the U.S. District Courts who preside
over cases with juries. Given that the USSC only hears a small number of cases each year,
the U.S. Courts of Appeals ultimately serve as the court of last resort for many cases in the
American system of justice.

In order for the U.S. Courts of Appeals to hear a case, it must be appealed from
the lower district court. All criminal cases in the United States are granted one appeal with
representation. This results in a much larger caseload because they are required to hear the
first appeals in a case and any subsequent appeals that the Court finds worthy of additional
review. Unlike the Supreme Court, the Courts of Appeals do not have the ability to set their
agenda. Understanding how judges make their decisions has been a well-researched field
of study in Public Law. However, this scholarship often has an emphasis on the USSC.
Given that the majority of research in the field of judicial behavior and judicial decision-
making focuses on the USSC, because past scholarship focuses this question on the
USSC, not much is known about decision-making at the lower court levels. Understanding
how and why judges in the U.S. Courts of Appeals decide cases that are beneficial because
many cases will not be accepted for further review by the USSC. The way in which judges
on the Courts of Appeals decides cases can have life altering impacts not only for people in
the criminal justice system, but any person who could be adversely impacted by a law that
is challenged.

Studying why judges decide cases is not a simple undertaking as there are many
different factors that influence a judge. Many judges state that they base their decisions
on the rule of law and previous rulings made by the court. By saying this, they attempt to
reaffirm the common law system in the United States and the importance of stare decisis.

However, as research in the field has shown, this simple answer fails to address the many factors that impact a judge's decision. These factors include the ideology of judges, the hierarchical approach judges take when deciding cases, the influence of other judges, the influence outside actors, and the psychological influences of decision-making. However, noticeably there is a lack of literature on how judges are influenced by collegiality.

Ideology

Ideology is one of the most researched topics in the field of judicial behavior and politics, and there is ample reason for it to be as such. Common perceptions of the court are based in the ideology of the judges, and even more so the presidents that appointed them. Bartels and Johnston (2012) found that the majority of Americans view the courts as political and would prefer that judges are nominated in a political and ideological manner. Interestingly, this preference for ideology does not carry over into the public's view of the courts' legitimacy. Americans did not view the court's ideology as a major determinant in their perception of the court (Gibson and Nelson, 2015). However, the public perception of the courts' ideological approach is not far from the truth. McKenzie (2012) found that federal judges in redistricting cases are likely to vote in either a partisan or constrained partisan manner. Moreover, when there is little precedent for the judges to follow, they will vote based on their partisan or ideological preferences. When there is a precedent to follow, they will limit their ideological and partisan behavior to rule consistent with the existing law (McKenzie, 2012).

Recently, a new concept in study of judicial decision-making for the Courts of Appeals has been the influence of panel effects. Panel effects refer to the impact that the panel composition has on the panel's decision-making process. For example, when judges are serving on a panel and one of the judges specialized in the subject of the case at hand, the other two judges are likely to move their ideology to match that of the specialized judge (Miller and Curry, 2017). This demonstrates that the judges are impacted by those around them when one of their colleagues possesses a certain set of knowledge, they will align themselves with their colleague and vote in the same manner if the case requires it.

Because of recent changes in who is appointing judges to the federal courts, there has been a shift in how these panels look and make decisions. Up until the 1980s, there was little difference between how Democrat and Republican panels made decisions (Kastellec, 2011). Since then, the way in which these panels decide cases depends heavily on who is appointing the judges making up the panels. Recently, the effects have been asymmetric with the effects having a larger impact on Democratic appointed judges (Sunstein, Schkade, Ellman, 2004; Kastellec, 2011). Often going hand-in-hand, the ideology of the court will influence whether or not those sitting on the court will abide by the current precedent (Kastellec, 2007). Not only does the ideology of the panel hearing the case matter, but the ideology of the entire circuit as a whole in addition to the Supreme Court (Kim, 2009; Collins, 2010; Kastellec, 2011a). Because of this dependence on how higher courts will respond, the influence will change depending on the contemporary interpretations and attitudes towards precedent (Westerland et al., 2010; Collins, 2010). This results in the courts being more responsive to the ideology of their colleagues.

Hettinger, Lindquist, and Martinek (2004) found that the ideological distance between the majority opinion writer and a judge was a better indication for how a judge would vote than the ideological difference between a judge and the circuit. They found that there was a positive and statistically significant result when comparing the majority author's ideology and that of another judge for increased likelihood of dissent. Meaning that as the distance between the two increases, the likelihood of a dissent being written also increases (Hettinger, Lindquist, and Martinek, 2004). These findings support the attitudinal model of decision-making rather than that of strategic models. Judges are dissenting because of ideological differences and not because of their desire to signal to higher courts.

In their 2015 study, Curry and Miller found that judges who are specialized in a particular area of law are more likely to vote in ideological consistent ways. Other judges in a panel, might defer to these judges to write the opinion because of their specialization in the subject matter. This is not a new concept in American government, as Congress has designated committees and subcommittees that take on more specialized issues. Often, these committees are filled with people who have subject matter expertise or are representing people who will be most impacted by this legislation. As a result, the main body of each chamber will cede some decision-making authority to these experts in order to save time (Maltzman, 1997). This allows for the committees to set the legislation closer to their preferred location rather than appealing to the floor as a whole.

Additionally, Curry and Miller (2015) found that those who are more likely to write majority opinions are also more likely to vote in ideologically consistent ways. An interesting aspect of this study is that the institutional specialization is not needed for there to be individual specialization. Because of this individual specialization can impact decision-making across different institutional environments (Curry and Miller, 2015).

The ideology of the panels does play a significant role in the decision-making process of appellate judges. It gives a basic understanding as to which way a judge leans for their preferred judgement. However, unlike the District Court judges, Courts of Appeals judges do not decide or hear cases in a vacuum. They have to contend with others on the panel who hold different worldviews and interpretations of the law.

Hierarchical Approach

In a similar way, another theory is that the lower courts will rule in accordance with higher courts out of fear of whistleblowing, or the idea that one member of the panel will dissent in an attempt to signal to the higher courts the need to review (Cross and Tiller, 1998). This form of strategic decision-making mostly revolves around a judge signaling to higher courts the need to review a case. Panels that do not have a uniform ideological makeup have the possibility of ruling in a way that is not necessarily consistent with the ideology of the majority. The presence of a different ideology could influence the majority to vote against their own ideology in order to avoid whistleblowing (Cross and Tiller, 1998). The appellate courts are highly responsive to the preferences of the United States Supreme Court (Clark, 2009). Circuits will respond to the perceived preferences by granting en banc review of cases they believe the USSC would take up (Clark, 2009). However, this is not always the case (Cross and Tiller, 1998; Beim, Hirsh, and Kastellec, 2014). The Courts of

Appeals dissent in less than 10 percent of the cases it hears, so the vast majority of cases are not cases where a judge thinks the benefits of dissent are great enough to do so (Beim, Hirsch, and Kastellec, 2014). When a judge does dissent in a case, they are more likely than not attempting to signal to the higher court the need for review (Beim, Hirsch, and Kastellec, 2014). It is also important to note that judges do tend to vote based on the law that already exists, and most of the cases that they see are cases with clear legal interpretations (Songer, Ginn, and Sarver, 2003). This means that there is little reason for these judges to spend time on dissents to straightforward cases.

Another way in which the hierarchy can influence lower court decision-making is in how the Supreme Court sets the decisional agenda. Songer (1987) found that the Supreme Court influences the decision-making habits of lower court judges in economic policymaking cases. The results of Songer's (1987) study found that when the Supreme Court made a decision in labor and antitrust policy from 1950-1977, the Courts of Appeals decisional trend followed suit.

Songer does point out that there are possible explanations for these changes outside of the Supreme Court's shift. The two most notable would be that there were changes in court compositions due to presidential changes and that there were changes in the Justice Department's prosecutorial policies. The first alternative was disproven as the percent of holdover judges shifted their decisions to match that of the Supreme Court. The second alternative is seen as less plausible because there was little to no evidence to support this explanation.

An additional theory on the principal-agent model is that the lower courts serve as an experimental environment for new areas of law (Beim, 2017). The Supreme Court will examine how the lower courts, especially the Courts of Appeals, craft and apply the law in order to create new doctrines that best apply the existing legal principles (Beim, 2017). While this is the case, the lower courts also will use split-intolerance of the Supreme Court to their advantage to push their policy agendas (Strayhorn, 2020). The Supreme Court's spilt-intolerance refers to the court reviewing more cases from split circuits in order to clarify the law. Lower circuit courts take this opportunity to craft legal arguments that make the best possible pitch to the Supreme Court. This also incentivizes judges with different ideological positions to dissent and present an argument to the higher court (Strayhorn, 2020). Corley, Collins, and Calvin (2011) found that the Supreme Court utilized the language and arguments used in lower court opinions, thus further demonstrating that the decisions in opinions at the lower court levels have an influence on the higher court's own decisions. In the end though, as Beim (2017) and Strayhorn (2020) note, the lower courts are used as a tool of the Supreme Court to create the best possible decision.

While the Supreme Court does utilize the lower courts as a legal lab, it also has to balance when to intervene in this process. Since many new legal issues are worked through at the lower court levels, the Supreme Court watches over these new developments and the potential disagreements between circuits as new conflicts that arise. Clark and Kastellec (2013) find that often the emergence of a conflict does not mean that an immediate grant of certiorari is likely. Instead, they find that the Court has an interest in letting the issue percolate in the lower courts as the new legal issue takes shape.

Lower courts do not follow precedent set at parallel courts (Kornhauser. 1995). This means that is the Ninth Circuit rules one way in a case, the Fourth Circuit could rule in another way. This creates a split between the lower courts that would require the Supreme Court to resolve. While this does create circuit conflict, this conflict is beneficial for the Supreme Court. More information and arguments made about new legal fields inherently benefits the higher court as it can come to a more informed decision. Essentially, the variations that occur in the lower courts are what allow the higher court to see which decisions work and which ones did not. In this way, the lower courts mirror that of an experiment quite well and it is not in the best interest of the Supreme Court to jump in as soon as a conflict presents itself.

Therefore, unless there is a major error made in the lower court decision, there is ample reason for the higher court to wait before it decides to step in and make a final decision. All while this is happening, the lower court judges are attempting to make their case. If the same issue arises in two circuits with two different ideologies, it is plausible that both of these circuits will come to a different conclusion, possibly to signal to higher courts to take on the case. In this way, the lower court judges are very aware that their arguments could be used in a Supreme Court case. Much like the previous whistleblowing literature, different circuits are doing their best to show that their argument and interpretation is the correct one. However, as Clark and Kastellec (2013) note, there is a downside to this. If the lower courts are mostly in agreement, then there is little for the Supreme Court to learn from the decisions.

Nonetheless, the way in which the appellate courts navigate this experimental field still impacts the lives of the litigants involved. It is difficult to say that ideology or principal-agent models alone do an adequate enough job at explaining the nuance in the decision-making process. One major source of possible influence is the influence of colleagues on the bench.

Influence of Other Judges

In addition to ideology and hierarchical approaches to understanding how these panels influence judges, it is important to understand how the presence of an underrepresented group or minority ideology on the panel influences judges. Whether it is the inclusion of a woman or a racial minority in a panel, the impact of their presence can be seen in the outcomes of certain cases (Boyd, Epstein, and Martin, 2010; Kastellec, 2013). However, it is important to first recognize how different judge's characteristics influence their own opinions. When viewing how different characteristics of a judge influence their judicial decision-making, it is imperative to look at all characteristics of an individual. For example, a female judge who is also a member of a racial minority is more likely to side with criminal defendants than either her White female colleagues or minority male judges (Collins and Moyer, 2008). However, when looking at each of those characteristics in isolation, being a woman or being a racial minority, there were no significant results (Collins and Moyer, 2008). This study shows that intersectionality plays a prominent role in the decision-making process of judges. These findings make sense as a person's lived experience is not isolated to that of their gender or race. A White woman and a Black woman can have two distinct lived experiences that can influence how they view different issues. These experiences can

then go on to influence how other judges are influenced by their presence. Markedly, the influence on another judge can be based on a single trait and the inclusion of a second trait can further influence fellow judges.

Kastellec (2013) finds that when there was a black judge in the panel, the likelihood that the panel would rule more liberally in affirmative action cases increases compared to if there was no black judge on the panel. This shows that the other judges are not influenced by the vote of the underrepresented group, but instead they are influenced by the presence of that judge. Similarly, when there is a woman present on a panel in cases of sexual harassment, the panel rules in favor of the plaintiff more often than when there is no woman on the panel (Boyd, Epstein, and Martin, 2010). In both of these cases, when there is a panel member who would be impacted in some way by the decision, the other judges will likely rule in a more liberal way. Neither one of these circumstances present a situation where a judge is influenced by the ideology of the minority member, nor is it a situation where the judges are considering whether or not the higher court will overturn the decision. These cases are examples of judges influencing other judges in social ways.

The chief judges in the circuit could also be a source of influence on judges as well. Howard (1981) conducted interviews and found that there was a perception that the chief judge can have great influence over new judges. In their study, Hettinger, Lindquist, and Martinek (2003) aimed to find whether or not the presence of a chief judge on a panel encourages there to be more agreement with less dissents if the chief judge writes the majority opinion and if the panel is less likely to reverse the lower court decision if there was a chief judge was present on the panel. They found that there is a decreased likelihood that a chief judge would dissent on a panel, and as a result the panel would also have a lower likelihood of dissent. They additionally found that the chief judge authoring the majority opinion had no significant influence on the rates of dissent. They found that the overall the presence of the chief judge is not indicative of how the colleagues of the judge would vote. As for the second hypothesis in their study, Hettinger, Lindquist, and Martinek (2003) found that if a former chief judge writes the opinion, or if a chief judge is on the panel, the panel is more likely to reverse the lower court decision. One possibility that Hettinger, Lindquist, and Martinek (2003) suggest is because the chief judge, or former chief judge, is the administrative leader of the circuit and as such views correcting lower court decisions as incredibly important. While unable to confirm the findings of Howard (1981), Hettinger, Lindquist, and Martinek (2003) did find that the chief judge's individual decisions might play a factor in how the panel will rule, but the title of chief judge is not a significant factor.

This then opens up the possibility that decision-making is not solely influenced by the law, ideology, or hierarchy. If judges are deciding cases differently based on the presence of other judges, then there is reason to believe that collegiality plays a role in this. While existing literature points towards an ideological or hierarchical approach to decision-making, the importance of collegial politics cannot be understated. Judge Harry Edwards (2003) made it a point to mention that there is a critical aspect of judicial decision-making that has been understudied, and that is collegiality. Edwards argues that collegiality is important for judges because it helps them come to an agreement, but he also argues that as the court becomes more collegial the less likely the court is to decide cases on legal merits (Edwards, 2003). Because of his experience as a judge on the Court of Appeals, it would be

injudicious to ignore this aspect of decision-making. Literature suggests that the collegial aspects are influenced by ideology and hierarchical politics, and that the ideological differences within panels pushes the judges to rule in a way that aligns more with the higher court (Kastellec, 2011a). However, this does not take into account what the impact a multiyear professional relationship has on the ultimate decision-making. In addition to this, the relationships formed in these courts are different than those in the Supreme Court.

This ties into how the structure of the Courts of Appeals influences the way judges decide cases. As previously mentioned, the federal appellate courts are an intermediate court between the lower District Courts and the higher Supreme Court. As a result, the structure of the Courts of Appeals is different than either of the mentioned courts. Unlike the District Courts that hear cases with one judge and a jury or the USSC that hears cases as one permanent panel, the U.S. Courts of Appeals hears cases on random, rotating three judge panels (Levy and Chilton, 2015). These panels are assigned differently in each circuit with the main goal of obtaining the most random outcome possible (Levy, 2017). However, because there is no federal regulation of these panel assignments, the level of randomness varies from circuit to circuit. For example, the Ninth and Fourth Circuits demonstrate this well because they have different methods of panel selection. The Ninth Circuit has some additional criteria regarding the number of times a judge must hear a case with another judge and where they hear that case given the large size of the circuit (Levy, 2017). The Fourth Circuit, however, only ensures that the judges sit with each other an approximately equal number of times and manually creates panels to hear cases that they already have a history (Hooper, Miletich, and Levy, 2011).

Influence of Outside Actors

Groups outside of government have attempted to influence the policymaking process of government for centuries. Most often these outside influences come in the form of interest groups and lobbyists. Interest groups and lobbyists are typically associated with Congress because that is where the majority of policymaking takes place and where it is easiest to gain access to policymakers. Even so, these interest groups do find their way into the other branches of government in their attempt to change policy.

Outside of the judges and lawyers, there are other actors who attempt to influence how a court rules in a case. One method for outside parties to involve themselves in a case is to file an amicus curiae brief. These briefs are filed on behalf of one party and attempt to strengthen the case for that party. Often, these are from interest groups who have a vested interest in the outcome of a case. At the Supreme Court level, there have been several studies looking at the influence of amicus curiae briefs. Collins (2007) found that these briefs were effective at influencing the justices through their persuasive, organized arguments. The nature of the decision is not the only influence that these briefs had on the Supreme Court. Depending on the quality, reputation, and ideology of the brief, it is likely that the language used in the briefs would also be used by the justices themselves in the opinion of the Court (Collins, Corley, and Hamner, 2015).

When dealing with the Courts of Appeals, Collins and Martinek (2010) find these amici briefs help to counter the tendency to affirm lower court decisions. In a study,

Collins and Martinek (2010) used a dataset of cases from all circuits from to 1997-2002 to determine how amicus briefs influence the decision-making process in the Courts of Appeals. The results were that amicus curiae briefs that support the appellant enhance their likelihood of success, but amicus curiae brief supporting the appellee do not shape the litigation. Because of the propensity of the Courts of Appeals to affirm lower court decisions, amicus briefs filed on behalf of the appellant help even the playing field and increase the chances of the Court ruling in that litigates favor (Collins and Martinek, 2010). Interest groups are also more successful when the cases are dealing with legal issues that are not able to be objectively decided (Collins and Martinek, 2010). Moreover, interest groups that can craft persuasive and well written arguments have a greater likelihood of influencing the judge.

These results differ from how effective amicus briefs are in the Supreme Court. At the Supreme Court both sides benefitted from the use of amicus briefs, but the appellee received a larger benefit from the use of amicus briefs (Kearney and Merrill, 2000). Both of these findings illustrate how amici can change the predisposition of the courts (Collins and Martinek, 2010). If a court is more prone to decide for the appellant, then the introduction of amici can then help the appellee level the playing field and increase their chances of success. The opposite is true as well, so this demonstrates that the judges are both the Supreme Court and Courts of Appeals are cognizant and sensitive to the use of these briefs. As a result, this serves as an effective way for interest groups to insert themselves and try to influence the decision-making process of judges and the judicial branch.

The judicial branch is also limited in their ability to enforce their decisions, particularly when they are faced with cases involving lateral issues. These lateral issues often involve other branches of government and would require those branches to comply with the ruling. As a result, there is the fear of non-implementation. Hall (2014) finds that this is a major factor for Supreme Court justices when deciding their case. A decision that is ignored by the other branches of government could prove disastrous for the entire judicial branch because it is dependent on other branches cooperation. It is possible that lower courts, such as the Courts of Appeals, face similar issues when deciding cases. However, as Kornhauser (1995) notes, they are not fearful of noncompliance in other circuits as they are not obligated to follow precedent in parallel courts.

Another possible influence on the decision-making process would be the influence of public opinion. At the Supreme Court level, the Court is likely to respond and rule in accordance with public opinion in non-salient cases, but for salient cases they are more likely to rule in a counter majoritarian manner (Casillas, Enns, and Wohlfarth, 2011). The influence of public opinion is most strongly seen in moderate judges who hold a swing vote (Mishler and Sheehan, 1996).

However, on the Circuit Courts, the influence of public opinion is not as prominent. Barring any changes in court membership or congressional shifts, the Circuit Courts experience little influence from the general public (Calvin, Collins, and Eshbaugh-Soha, 2011). The main method of influencing the Circuit Courts is through the replacement of judges when they retire or pass away. Given that judges are appointed by the president and confirmed by the Senate, the changing of who nominates and confirms these judges serves

as the closest the public gets to influencing this isolated section of the judicial branch. Songer (1982) indicates that home state senators can have a profound influence on the selection and nomination of judges in the Courts of Appeals. Senators play an influential role in shaping how a judge will make decisions, particularly when the senators and president are from the same party. While there is no absolute veto power for a senator, they can have significant influence on this process. This influence can manifest in a way that a president might select a nominee who is less than their ideal nominee, but the norm of clearing with the home state senator will result in a nominee that is more favorable to the senator.

As a result, this has direct implications on how the judge will adopt policy opinions and influence their decision-making process (Songer, 1982). When there was a judge nominated from a state with liberal senators, then there was an increased probability that the judge would adopt a liberal voting record. The results are reversed when a judge is nominated with conservative senators. If the senators are conservative, then it is likely that the judges will also be conservative. Songer (1982), also notes that the prevalence in home state senators in the nomination process has been consistent, but that the consequences of this involvement has been more prominent with senators in the Democratic party.

In a follow-up study conducted in 2002, Singer and Ginn investigate a similar question as before. The new study expands the original paper by looking at the regional and partisan factors influence the decision-making process. Songer and Ginn (2002) found that the president's political preferences were evident in the judicial behavior of their appointees but are still slightly limited by the home state senator's preferences. This is especially true after negotiation with senators of the same party. When the home state senators are from the opposing party, the only preference that matters are that of the appointing president.

Another potential constraint to who the president chooses to appoint would be the ideology of political elites of the same party from that state. This is more pronounced when there is no senator from the president's party in the state. This appears to be an informal pressure, but it was a statistically significant result (Songer and Ginn, 2002). Interestingly, states changing their ideological position after an appointment does not have a significant impact on how the judge's judicial behavior.

This aids the explanation that a shift in senatorial and presidential control can change the composition of the Court. If a more conservative senator is to be elected, then there is an increased likelihood that the circuit that state resides in will see a possible conservative shift in decision-making. As an additional result, this demonstrated how public opinion influence the Courts of Appeals in an indirect manner. Since senators are more sensitive to the will of the people than judges, the public opinion influence will most likely be demonstrated in who the senator pushes to have nominated to the bench. Still, this influence is very indirect and momentary. Public opinion can shift quickly, and the judges are not held accountable to the public. It additionally shows that factors outside of federally elected politicians can have an influence on the judicial decision-making of judges on lower courts.

These findings intuitively make sense. The Courts of Appeals are regional, and as a result, their decisions do not have a national impact. A judge's decision in the Fourth Circuit

has no impact on a judge's decision in the Ninth Circuit and vice versa. Ensuring that the home state senator's political values are matched in an appointee is important. It helps the party because there will be another judge on the bench with an ideology that matches the region, but also gives the senator or political elite more clout to run off of when it come to an election.

The Psychology of Group Decision-making

While the panels' decision-making is framed in the context of law and courts, there is an important and unavoidable psychological aspect to group decision-making. Psychological research has analyzed the group decision-making process. One of the most prominent theories on how groups make decisions is the theory of groupthink. Groupthink is the theory that small groups will move towards consensus (Janis, 1982). If this idea is extended to the courts and panel decision-making, this would mean that the panel will strive to find consensus and often this consensus will come at the expense of the minority opinions. However, existing literature finds that this is not necessarily the case. Reid, Schorpp, and Johnson (2020) found that women are able to successfully mitigate the effects of groupthink on panels. Showing that diversity of a panel is important for ensuring that the decisions are an effective check on the other branches. A plausible question to ask, and one being asked in this research study is: how does this impact groups of friends? Hogg and Hains (1998) found that friendship in groups decreases the effects of groupthink, as people who see fellow group members as friends are more likely to speak openly about their disagreements. In other words, when people know each other well, or view each other as friends, they are more likely to engage in discussions that would openly challenge each other's belief. In terms of judge panels, theoretically, the more judges engage and interact with their peers, the more they are willing to voice their dissent and present opinions that might stifle the urge to find consensus with the majority.

As previously discussed, racial diversity is one of the factors that can impact how a panel decides a case. Usually, the presence of a judge from an underrepresented group will be able to influence the decision-making of the panel. When homogenous groups, such as a panel composed of all white judges, sit to decide cases, the discussions often lack considerations of topics that would otherwise be discussed if there was a diverse panel (Sommers, 2006). The diverse groups often engage in conversations discussing a larger array of topics, facts, and viewpoints. These conversations were longer than that of the monolithic panel and included fewer factual errors (Sommers, 2006). Sommers (2006) more importantly found that the benefits sprouting from diversity are not solely due to the contributions of the individuals in the minority. Thus, this furthers the evidence that Kastellec (2013) found, that the presence of a minority or underrepresented judge will influence the outcome of a case. When connecting this to the court, it is clear that the presence of a judge with a different background does impact the decision-making of the panel.

Emphasizing this further, Andreas et al. (2008) found that when information was presented that was preference-inconsistent and it was socially validated, then the information had a greater impact on the decision of the group than preference-consistent information. When a minority opinion of the group is presented and discussed and is socially validated, it can influence the final decision of the group more than information that

conforms to the majority's point of view. Implications of this on the Court of Appeal's panels would be that when a member of the minority presents information that was able to be verified and validated, it could change the opinion of the court. This would challenge the idea that judges are making decisions based solely on ideology or fear of eventual overturn by the USSC.

Additionally, diverse thought and dissents in a group's discussion increases the likelihood that the group came to the correct conclusion or avoids the suboptimal decision (Schulz-Hardt et al., 2006). Extending this to the courts, when a panel is discussing the facts of a case, the presence of a judge in the minority could have the ability to sway the other judges, not simply because of the fear of whistleblowing, but because the dialog presents different points to consider. Given that there could be a majority and minority in judge panels, it is fair to say that a judge in the ideological minority can use their dissent as a means to discuss points of view that the majority might have otherwise not considered.

This research shows once again that the people who a person is surrounded by can have a significant impact on their decision-making process. In the context of judge panels, the influence of others is constantly changing given their inconsistent nature. Nonetheless, the influence of others is an inescapable reality for the U.S. Courts of Appeals. Judges, much like any other individual, are subjected to the same psychological influence of their peers. While it is not a negative, in fact the research shows quite the opposite, it is an understudied area.

In summary, psychological research has shown that diversity on panels can help mitigate the effects of groupthink and encourage members to consider different points of view. This supports the theory that judges are influenced not only by ideology, but also the intergroup relations of the panel. Taking into account Judge Edwards' (2003) statements, the current structure of the Courts of Appeals, and the psychological research of group dynamics and decision-making, it appears that the motivations behind a judge's decisions are not as one dimensional as previously thought. Judges deciding cases in panels are not immune to the group decision-making effects that the average person experiences. To treat judges in this way would ignore the basic psychology of what makes a person a person. Furthermore, there is evidence that judges on these panels would be more so impacted give how often they interact and engage with each other.

Theory and Hypotheses

There is extensive research and literature on how judges come to the decisions that they make. The decision-making process is not a process that happens in a vacuum where only one factor plays a role. It is likely that all of the previously discussed factors influence the behavior and decision-making process of appellate court judges. However, in the literature there is still the lack of how personal relationships between the judges influence their decision-making process.

Literature has shown that judges influence one another based on ideology, hierarchy, gender, and race. The question still remains about how a judge is influenced by extrajudicial and social factors such as collegiality. If judges are spending hours together in a room

debating the legal merits of an argument, it is a logical assumption that these judges could grow closer together and view each other more as friends than a simple coworker.

I put forward the theory that collegiality is the driving force behind what influences judges in the Courts of Appeals, and that the more time judges spend with each other hearing and deciding cases, the more likely they are to decide cases together in the future. More specifically, I am analyzing the difference between the Ninth and the Fourth Circuits to measure whether there is any relationship. I chose to use the Ninth and Fourth Circuits because they have different methods of panel selection. The Ninth Circuit has some additional criteria regarding the number of times a judge must hear a case with another judge and where they hear that case given the large size of the circuit (Levy, 2017). The Fourth Circuit, however, only ensures that the judges sit with each other an approximately equal number of times and manually creates panels to hear cases that they already have a history (Hooper, Miletich, and Levy, 2011). This theory leads to the following hypothesis:

H0: There is no difference between the number of times a judge sits with another judge and the likelihood that they will vote together in the future.

H1: The more a judge sits with another judge, the likelihood that these judges agree with each other increases.

I hypothesize that the more interactions that the judges have in any given professional interaction will create an environment that is more conducive for them to agree with each other while on a panel together. This is how I aim to quantify the collegiality that Judge Edwards discusses in his 2003 article.

Methodology and Data

In order to test my hypothesis, I created an original dataset using cases from Westlaw. I collected information from criminal cases in the Ninth and Fourth Circuits from 2009 to 2019. During this time period there were two different presidents in addition to different chief judges in both circuits. The inclusion of different chief judges will help to alleviate a single judge's behavior from skewing the results. Given that the literature shows chief judges tend to act in an individual manner, choosing a time period with more than one judge is imperative. Similarly, given that the president can have a large influence on the composition of the judicial branch, choosing a time period with different presidents is important. In this time period, there was one Democrat and one Republican president.

From these cases, I looked at the opinions and recorded the judge pairs for each case. I did not include any en banc cases as the decision-making process is different. En banc decisions are made in a similar way to that of the Supreme Court, and as a result do not fall under the focus of this paper. A case that is heard en banc is heard by the entire circuit, or by 11 judges in the case of the Ninth. The purpose of this paper is to examine how three judge panels make decisions. The data from these cases were entered into a dataset where I assigned variables and corresponding codes.

The dependent variable, Agreed, is whether or not the judge pair agreed in the

decision, so a case would be coded aa 0 if they did not agree (a dissent or partial dissent was submitted) or a 1 if they concurred or joined in on the opinion. There was an additional variable, Partial, added to note whether the dissent was a partial dissent or not. Like the Agreed variable, Partial is a dummy variable where 1 indicates that there was a partial dissent and 0 indicates that there was not partial dissent. The Agreed variable will show whether or not there is any change in how the judge pair votes. According to the hypothesis, it is expected that judges will agree, or vote, with each other the more times that they sit together. So, as Times Together increases, so should the likelihood that they vote together.

The independent variable, Times Together, is the number of times they sat together, and this was coded based on the number of times the judge pair appeared together in any criminal case from 2009-2019. Times Together is a running total of all times that the judge pair sat together starting in 2009, which makes it an interval variable. For this dataset, it is assumed that the judges have not sat together prior to 2009, and as a result the variable is a 0 for all judge pairs that year. This variable is important because it is the main independent variable in the dataset. It is how this study attempts to quantify collegiality. Therefore, it is expected that the lower this number is, there is a greater likelihood that there will be a dissent.

Other variables that were included as controls would be the Ideological Distance, the Circuit the case was heard in, whether it was Reported, whether the case a Death Penalty case or not, and whether or not there was a District Judge, Senior, Other Circuit Judge, or the Chief Justice of the circuit. The Ideological Distance was the absolute value of the difference between the judges' ideology using the Judicial Common Space values for the Circuit Courts of Appeals and Federal District Court Judge Ideology Data (Epstein et al., 2007; Boyd, 2015). Controlling for the ideology is important because of how prominent the attitudinal theory of decision-making. The vast nature of this theory makes it imperative to control for, as it is very possible that ideology could play a major role in how judge's come to their final conclusions.

The coding for the Circuit was coded as a dummy variable where if a case occurred in the Ninth Circuit it was coded as 1 and if it occurred in the Fourth it was coded as a 0. This was a control variable because of the different methods used to assign judges to panels. Given that this study is focused on whether or not time together is important in how judges make decisions, choosing two circuits with different methods helps to see if that was an additional factor. It also allows for control of potential regional and circuit differences.

Coding for whether a case was Reported was also binary where if the case was reported it was coded as 1 and if it was unreported it was coded as 0. Depending on the circuit and type of case, there could be more reported or unreported cases. More often than not, cases that the circuit views as more important or significant will be reported. Given that there are many cases in the Courts of Appeals, not all cases will have the same level of importance.

The Death Penalty variable was coded as a 1 for if it was a death penalty case and 0 if it was not a death penalty case. One reason for the importance of this is because the death penalty is a highly salient issue. Many people have solid views on whether or not

they support capital punishment or not. As a result, the saliency of the case could present a situation where judges might behave differently than expected. Another reason to include this is that it is not only salient, but it has permanent ramifications. Since these courts will most likely be the court of last resort for most of these capital cases, the judges could also take a different approach to how they decide the case.

Once again, the coding for the presence of a District Judge, Senior, Other Circuit Judge or Chief Justice was binary for each variable with a 1 indicating the presence of the respective judge and a 0 indicates the lack of the respective judge in the pairing. Each of these variables were chosen because of the potential influence they could carry on the panel. For example, Chief Justice is coded for the chief judge of the circuit. Given the literature shows a possible influence of the chief judge, a variable to control for its effects is needed.

Table 1 shows each of the variables and how they were coded.

The dataset produces a total of 5,582 judge pairs from approximately 1,860 cases during the ten-year time period. This is a significant number of cases, but it is still only a portion of total cases heard by each circuit. Additionally, the counting for the Times Together variable started with all pairs receiving a 0 in 2009. I did this to simplify the counting and as there would be thousands of cases prior to this. As a result of this, there is an underestimation in the total number of times each pair sat together.

I ran an earlier dataset using the same criteria, but instead of all criminal cases from 2009-2019, I used all death penalty cases from 1970-2019. This dataset was significantly smaller with only 604 pairing from approximately 201 cases. When running a logistic regression with this set of data, there were different significant variables. Namely, the Circuit and Reported variables. However, because the dataset was so small and limited to a salient issue, I decided to return to the dataset and expand the types of cases and limit the number of years.

The first iteration of the data lacked the types of cases that the judges hear on a daily basis. As Casillas, Enns, and Wohlfarth (2011) explain, the court could be acting in a counter majoritarian manner in issues with high saliency. As a result, it was likely that the judges' behavior in these cases was not the same as more mundane and common appeals. To mitigate this impact, I decided to include all criminal cases in the dataset. Because of this inclusion, I decided to reduce the time period to the last decade of cases.

Analysis

To run the data, I used a logistic regression because the main dependent variable was a dummy variable with the only input as 1 or 0. I ran this test through Stata and found the main dependent variable for my first hypothesis to not be statistically significant, and therefore I am unable to reject the null hypothesis in favor of the alternate. Table 2 shows the results of the logistic regression in the form of a chart.

There were four variables that came back as statistically significant. The first one that came back as significant was Ideology. Consistent with the current literature, the ideological distance of a judge influences how the judge will rule in a case and whether or not they two will agree. Specifically, the variable was significant at the .1 level and was moving in a negative direction. As the ideological distance of the judges increases, the likelihood that the judge pair will vote together decreases. When holding all variables at their mean, there is a 90% probability of judges voting together when their ideological distance is 0. The probability decreases to 88% when the distance is .5, and further decreases to 87% when the distance is 1. This finding is expected because the majority of existing literature demonstrates that ideology does play a significant role in the judicial decision-making process.

The second variable that came back as statistically significant was the District Judge variable. This variable was significant at the .01 level and is moving in a positive direction. When there was the inclusion of a district court judge in the pair, there was an increased probability that the judge pair would vote together. When holding all other variables at their mean values, there is an 88% probability of judges voting together when a district judge was not present. This probability increases to 92% if there was at least one judge in the pairing. This could be attributed to the district judge not being as familiar with the different judges and being seen as a guest judge. The perceived seniority or rank of the lower court judge might influence their willingness to dissent in a case.

The third variable to be statistically significant was the Chief Justice variable. It was significant at the .01 level and moving in a negative direction. When the chief justice of the circuit was sitting on a panel, the probability of the judge pair agreeing decreases. Holding all other variables at their mean values, the probability of judges voting together was 89% if the chief judge of the circuit was not in the pair. The probability decreases to 84% when the chief justice is present on the panel. Notably, this finding is antithetical to that of Hettinger, Lindquist, and Martinek (2003) findings. In their results, they found that there was lower likelihood that a chief judge would dissent. However, in the current study, when a chief judge was present on a panel, there was an increased likelihood for dissent. Opposite to the effect of a district court judge, it is possible that the seniority and rank of the chief judge would give them comfort in their decision to dissent. It could also mean that the chief justice is behaving like a whistleblower or signal to higher courts that they believe this case needs additional review.

The final significant variable was the Death Penalty variable. This variable was significant at the .05 level and is moving is a negative direction. If the case was one revolving capital punishment, then the probability that the judges will vote together decreases. With all other variables at their mean value, the probability of voting together is 89% if it was not a capital punishment case. However, that probability falls to 81% if it was case involving the death penalty. One explanation could be the saliency of the issue. Unlike other criminal cases, capital punishment is a deeply ideological issue and is influenced by many factors both judicially and personally. It is possible that a judge views these cases differently because they also carry a heavier consequence.

Overall, when setting the significant variables at their maximum value for voting together, and all other variables at their mean value, there is a 93% probability that the judges will vote together. Conversely, when setting the significant variables at their minimum values, and all other variables at their mean value, the probability falls to a 69% likelihood that the judges will vote together.

There appears to be no difference between the two circuits in how their different methods influence the decision-making process. It is important to note, however, that the Ninth Circuit had a larger number of the judge pairs. Of the judge pairs, approximately 57% were from the Ninth Circuit and 43% were from the Fourth Circuit. This difference makes sense as there are more cases in the Ninth Circuit and as a result there will be more pairs to count. Noticeably, there was no statistically significant difference in the which Circuit created more agreeance. This can be explained by the fact that there was no statistical significance in the number of times a judge pair sat together and whether or not the agreed. Based on this, I am unable to conclude that the different methods of panel assignment played any role in fostering an atmosphere that would encourage judges to work together.

Discussion/Conclusion

With the current data presented in this study, I am unable to say what impact collegiality plays on the decision-making process. Time spent together on cases does not provide the answers to the question of what drives this collegiality. However, this study does reinforce the current literature on ideology and the influence of it on a judge's decision. Specifically, it most corresponds to the findings of Hettinger, Lindquist, and Martinek (2004). While there are slight differences in how the study was conducted, such as this study not looking specifically at the majority opinion writer, they are still very similar. Both studies demonstrate that there is significant reason to believe that ideology is a significant factor in how a judge comes to their ultimate decision. I do recognize though, that this current study did not aim to investigate the differences in attitudinal and strategic models. Regardless, it shows how the distance between the judges can influence the process.

Another aspect that was shown to be significant was the influence of ranking in the circuit. When the chief judge of the circuit was present, there was an increased chance that there would be a dissent. This difference in findings from literature, notably Hettinger, Lindquist, and Martinek (2003), could demonstrate that there has been a change in how the panels view and react to a chief judge on the panel. It could also just be an indication that the chief judges in that were represented in this study were more likely to dissent. As Hettinger, Lindquist, and Martinek (2003) point out, the behavior of chief judges is highly dependent on the individual. Future research could reexamine the question of how the chief judge influences the panel, especially in this new period of polarization. This contrasts with the increased chance of agreement when there was a district court judge present. As stated previously, this could be the result of the lower court judge not aiming to cause any sort of disruptions during their brief stay in the Court of Appeals.

The influence of a death penalty case on the judges showed that the saliency of the issue could possibly influence the decision-making process. Perhaps the judges are responding in the counter majoritarian way Casillas, Enns, and Wohlfarth (2011) theorize.

They could be rejecting the popular opinion and ruling in favor of their ideology. This research did not attempt to examine that question, but it is an interesting one that would serve to help further understand the decision-making process of contentious issues.

All of the findings indicate that issues other than time together can possibly explain the decision-making process for judges in the Courts of Appeals. I am unable to say that any one of the statistically significant variables are direct causes, but they do provide future research opportunities. Given these results some areas such as saliency and the influence of the chief judge should be revisited. The last decade has seen an increase in political polarization, it would be interesting to see if the judicial behavior has changed alongside this increase. As the other branches place increased attention on the Supreme Court, it is possible that this newfound attention could place new pressures on the judges.

Further research can also be done using this method but expanding the dataset once again to include more cases, circuits, and years. One limitation this paper faced was that it focused solely on two circuits and one area of law over a decade. The underestimate of times a judge sat together could be a possible explanation for the lack of results, however, because this study does not look at more years nor does it include time together prior to 2009 I am unable to state whether or not this is possible.

There are a few drawbacks to this study. The first and most difficult to overcome would be the inability to accurately quantify collegiality. Judge Edwards stated that it was an understudied area of judicial decision-making, and it is clear as to why that is. This study aimed to quantify collegiality by using time together on a panel as the driving factor. However, as the data demonstrates, this did not prove to be statistically significant. It could be that this paper is not addressing the proper question and collegiality is not the proper term for this occurrence. Given that collegiality involves more than simply agreeing with people one works with, it is possible to miss out on other vital events that shape the judges' perceptions of one another. Interactions, or lack thereof, outside of the courtroom might have another significant influence on the decision-making process. Alternatively, if there were to be an insight into the deliberative process of the judges in their decision-making process, this could also provide more insight into how the judges interact with one another. Unfortunately, both of these options are not currently available to researchers.

Another drawback would be that these cases could have a clear, objective legal doctrine. If there is no room for interpretation of the law, there is little room for there to be a disagreement. Because most of the issues can be answered with existing precedent, there is little justification for the judges to break away from it and risk the case possibly being overturn. This could also explain why the Death Penalty variable was significant. Because of the complexities of capital punishment cases, there is a higher chance that there will be a subjective interpretation of the law. This can also be a place where ideology and the influence of other judges come into play. As there is less legal precedent, there is a greater chance for other factors to actually influence the judges.

Nevertheless, this study failed to adequately measure the collegiality of a judge pair and how that would influence the decision-making process. This research better serves as a measure of whether time together in deliberation influences that process. It does not

appear that this is the case. It does, however, further confirm the literature that already exists in demonstrating how ideology influences judges. There are also too many other factors that can go into the social relationships of humans to adequately assess this question in a purely quantitative manner. Thus, this question might better formulate as a qualitative question where the behavior of the judges is better able to be observed and analyzed. There are far too many difficulties trying to find a quantitative measurement of this type of human behavior.

Collegiality between judges is not a new concept, nor is it one that is a well-kept secret. One of the most recognizable friendships between jurists was the relationship between Justice Scalia and Justice Ginsburg. Both of these Supreme Court Justices were figures for their respective sides. Justice Scalia was a staunch conservative who is many conservative politicians and figures still quote today. Justice Ginsburg, on the other hand, was a symbol of liberal ideology on the Court who inspired many and opened the doors for people to walk through. While both of these figures were opposites in ideology, they had an incredibly strong friendship that involved attending many operas and other events together. Despite this, they were still often on different sides of the decision. Perhaps, this is the best demonstration of how there can be collegiality without agreement. It is entirely possible to be friendly and have close friendships while also holding firm to your ideology or interpretation of the law.

In the end, this might be the better option as it mitigates the influence of groupthink. The Courts of Appeals is the court of last resort for the vast majority of cases, and it is more important for judges to make decisions that they feel is the right legal decision instead of siding with the majority because they have a friend on that side. Courts of Appeals judges also are extremely bound by the current precedent, and because the basis of the American judicial system is rooted in the concept of stare decisis, it is of the utmost importance that these legal precedents are followed. If they are not, then the entire system will collapse in on itself.

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Appendix

Table 1: Description of Variables Used in the Study

Variable	Description
Judge Pair- Year	Name of Judge A, Judge B, Case Number, Year
Voted Together	1: Voted together 0: Otherwise
Times Together	Equals running total of times judge pair sat together in criminal cases prior to this case, starting at 2009
Ideology Judge A	Ideological score of judges from Judicial Common Space
Ideology Judge B	Ideological score of judges from Judicial Common Space
9th Circuit	1: Case was within the 9th Circuit 0: Case was within the 4th Circuit
Other Circuit Judge	1: Visiting circuit judge was present 0: Otherwise
Reported	1: Case was reported 0: Case was unreported

Death Penalty	1: Case was a death penalty case 0: Otherwise
District Judge	1: District judge was present 0: Otherwise
Senior Judge	1: Senior judge was present 0: Otherwise
Chief Justice	1: Chief judge of the circuit was present 0: Otherwise
Partial	1: Partial dissent (also coded as 0 in *Voted Together*) 0: Otherwise
Ideological Distance	Equals absolute distance between Judge A's ideological score and Judge B's ideological score

Table 2: Logit Regression Table

Variable	Voted Together
Times Together	.001 (.008)
Ideology Distance	-.261* (.148)
Circuit Court	.081 (.103)
District Judge	.514*** (.136)
Other Circuit Judge	.130 (.256)
Chief Justice	.418*** (.140)
Death Penalty	-.611** (.294)
Senior Judge	-.104 (.103)

N=5582
Robust Standard Errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Salcedo   **Criticism of Legal Appeals to Insanity**
Marissa

Abstract

In this paper I analyze two views for defining insanity in the law, namely the M'Naghten test and Durham Rule by giving an account of the two views definitions, briefly describing their history, and explaining how they're used in court. I ultimately argue against both views by claiming that the former's definition is too narrow, and the latter's definition is too broad; while both do not provide an accurate account for the way mental disorders affect one's cognition or emotions so that they would cause them to not be considered responsible agents. Next, I raise two alternative views for defining insanity in the law, one called "Defense of Insanity [nonresponsibility due to mental disease]" and the other called "Psychotic Delusion Defense." After analyzing both views I endorse the latter. Then I raise a possible objection to the endorsed view which leads me to revise it so that it can encompass both mood disorders and psychotic disorders; therefore, broadening the disorders that count for making one be deemed "insane" but also limiting the cases that can claim insanity based on the way their disorder affected their mind or mood. Lastly, to give a better understanding of the way all insanity views would be used in the courts, I provide a case example using the circumstances from the criminal case of Andrea Yates.

Introduction

One of the most difficult cases to work are the ones involving defendants who are insane or have a form of mental illness. One thing that makes these cases particularly difficult is explaining the criterion for insanity to jurors and drawing the line between the defendant's act(s) and their mental illness. Another issue is proving the fact that the defendant is "insane" in the way the law defines insanity. This is difficult because psychiatrists usually have to get involved and evaluate the defendant; additionally, it is not uncommon for a few different psychiatric professionals to have opposing views in regard to the defendant's mental state. Another issue is that of being "fit" to stand trial, for those with severe disorders, such as schizophrenia, quite a bit of medication may be needed for them to be "fit" for trial. Not only is this troubling because the defendant may still not be in the right state of mind for trial due to over or under medicating; but it is also misleading for the jurors and may cause some of them to think that the defendant is lying about their mental state because they seem fine in the courtroom. While these issues previously mentioned are important to discuss in order to provide a fair trial for mentally ill offenders, they will not be my focus of this paper. Instead, I would like to focus on the laws for defining insanity themselves. I am choosing this as my focal point because, in my belief, if our legal definitions for insanity are flawed, the rest of the court processes are automatically compromised. So, focusing on finding an accurate account of mental illness in the law's definition is the first step toward providing fair trials for mentally ill offenders.

This paper will criticize our current ways of defining insanity in the law, namely the M'Naghten test and the Durham Rule, by making the claim that they do not adequately define mental illness, nor do they account for the ways in which these mental conditions affect one's cognitive ability to the point that it would cause one to be held, or not be held, legally liable for the acts they committed. I will begin by explaining the ways the M'Naghten

test and Durham Rules work as a legal defense by defining them, explaining their requirements, and providing examples of how these laws would be applied to a case. Next, I will criticize these views and show that the former fails to account for various types of mental illnesses and the latter is too lenient in its definition that it allows for people with mental disorders to not be held legally liable even in circumstances where they should be. Then, I will describe other theories of defining insanity in the law and I will defend the theory that I believe offers the best account for defining mental illness because it places an emphasis on understanding the ways in which mental disorders affect one's mind through, what the author calls, psychotic delusions, all while upholding the integrity of the law. After, I will consider an objection to the view that I am defending which claims that the view is deficient in accounting for all types of mental illness because it only accounts for conditions that affect cognition. Lastly, in light of this objection I will respond by adding in a new requirement to the law that will account for mental conditions that play an affective role rather than a cognitive one.

Legal Defen ses of In sanity: M'Nagh ten an d Du rham Rule

I will begin this venture by explaining the M'Naghten test and M'Naghten based statutes. The M'Naghten test for insanity asserts that a person cannot be held criminally liable for an act if at the time of the act he or she suffered from a defect of reason, meaning they were unable to know right from wrong, and did not know or understand the nature of the act they were committing. This tests purpose was to focus more on cognitive insanity and one's ability to know right from wrong rather than allowing all forms of mental illness, such as personality disorders, to be sufficient for deeming one insane. This rule was enacted in England in the year 1843 after a man named Daniel M'Naghten tried to murder England's prime minister because he (falsely) believed that the prime minister wanted to kill him. While attempting to shoot the then prime minister of England, M'Naghten instead shot and killed the prime minister's secretary. During M'Naghtens trial he was found not guilty by reason of insanity, and after a public uproar demanding a strict definition of insanity, the M'Naghten became the new standard for England and was later adopted by the United States (Legal Information Institute).

Under the Durham Rule a person cannot be held criminally liable if they suffer from a mental disease or defect at the time an act was committed. This rule, that is sometimes called "the product defect rule," does not require an official medical diagnosis of mental illness and can even be used by people with drug addictions, or by gambling addicts, if the act committed was directly related to their addiction. An example of the way that would work is a drug addict (or gambling addict) who shoplifts so that he can sell those items to obtain the money he needs to support his addiction. You can say that the M'Naghten test gave way to the Durham Rule because in 1954 in the case of Durham v. U.S. the U.S. Court of Appeals found that the M'Naghten test did not account for some types of mental illness. So, the decision to simply question whether or not the defendant suffers from mental illness rather than relying on certain symptoms, such as knowing whether an act is right or wrong, would be able to encompass more forms of mental illness. While this rule was initially adopted, after criticism it has since been abandoned by all states except New Hampshire who has imposed more restrictions to this rule (Legal Information Institute).

Motivation of M'Nagh ten an d th e Du rham Rule Despite their flaws you may be wondering how these rules have maintained their popularity as a criminal defense. Well one reason may be that some insanity defense is better than none at all. In "Sanity and the Metaphysics of Responsibility" Susan Wolf states that, "…a responsible agent must be able to govern her [or his] actions by her desires, and her desires by her deep self. In addition, the agent's deep self must be sane" (Wolf, p. 369). I think most of us would agree that it would not be morally correct of us to prosecute people who suffer from mental illness in the same way and according to the same standards that we prosecute those without. This is because most of us recognize the fact that many people with mental illness cannot fully be held responsible for their actions. In "The Moral Basis of the Insanity Defense," the author writes that it is essential to the moral integrity of our law that we keep or maintain some form of the insanity defense (Bonnie, p. 194). Treating criminal acts performed by those with a limited cognitive ability in the same way that we treat those without such limitation, would be to marginalize those who suffer from mental illness. I believe this to be a reason as to why the M'Naghten test and the Durham Rule are still the most popular defense appeals to insanity and why they are upheld despite criticisms.

Another reason one might continue to support the M'Naghten test in particular is because of the standard it poses of being able to distinguish what is right, both morally and legally, from what is wrong and knowing the nature of those actions is intuitive with our common idea of a sane mind. So, if we are able to see that a person did not know what they were doing was wrong or that they did not know the nature of their action(s), we tend to think that there has to be some form of cognitive impairment that can be reason enough for not holding one legally liable. Whereas a reason to support the Durham Rule in particular is that it solves a flaw of the M'Naghten, namely that it is very narrow and does not encompass various types of mental illness. In this way some might believe that the Durham Rule is superior to the M'Naghten test because it allows for various circumstances and various conditions to be accounted for and protected under. So, for those like myself who believe that the issues posed to the mind and it's cognitive abilities by mental illness go beyond the ability to distinguish right from wrong and can cause other states of mind that may lead to criminal acts, whether intentional or nonintentional; the Durham Rule may seem, at the very least, like a good starting point for an insanity defense.

Criticizin g th e M'Nagh ten an d Du rham Rule

I believe that the M'Naghten test is flawed because it is worried about whether or not somebody narrowly knew the nature of the act they were committing and that it was illegal rather than acknowledging the psychotic delusions that cause people with various forms of mental illness to commit these acts (Whelan, pp. 28-31). While this information may be important to know, I believe that it is more important to know how a person's mental illness affected their cognitive ability to the point that caused them to not know that the act they were committing was wrong, or if they did know it was wrong, caused them to still act in this way without being able to conform their conduct to fit the expectations of the law. Additionally, I believe the M'Naghten is flawed because the criterion to claim this defense is quite difficult to prove, thus it is often unsuccessful as a defense; this fact may potentially lead to the unfortunate event where someone who is insane, and unfit to stand a regular trial, is deemed "sane" in terms of this test. The mentally ill defendant would then be

required to stand a regular court trial against charges that do not account for their mental illness, where if incarcerated they will be placed in jail or prison with the general population rather than in a facility receiving mental health treatment. Having an insanity defense that does not protect those who are insane is essentially like not having an insanity defense at all; which as discussed earlier would not be morally correct on our criminal justice systems part.

Similarly, the Durham rule is flawed because the simple fact that a person suffers from a mental disease or defect does not necessarily entail that they should be exempt from criminal liability. Knowing that a person suffers from a mental illness does not explain to us how their mental disorder affected their cognitive ability enough to the point that they either did not know what they were doing, did not know that what they were doing was wrong, or could not have stopped themselves from committing the act. In "Psychotic Delusion and the Insanity Defense" John Whelan Jr. criticizes this rule by asserting that whether or not someone suffers from a mental disorder, and whether or not that person should be held legally liable, are separate and unrelated questions (Whelan, p. 32). Here Wheelan is making the case that not every person who suffers from a mental illness should be exempt from legal liability. There are some factors that may or may not be present in each person's unique case that may lead the court and/or psychiatric professionals to decide how an individual's symptoms of their mental illness either directly related, or did not relate, to the act at hand. In the case that a direct correlation is present, that would be sufficient for the defendant's eligibility to use an insanity defense.

Proposed Response to Criticism

While knowing the way a person's mental illness affected one's cognitive ability to account for the nature of their act is important, it is extremely difficult to diagnose and know for certain how one was affected at the time an act was committed. So, while our legal definitions of insanity in the M'Naghten test and the Durham Rule are not perfect, they do the best they can with our limited knowledge of a defendant's cognitive abilities and mental state after the fact. The criticism against the M'Naghten which claims that it does not encompass enough forms of mental illness was resolved with the Durham Rule; and the criticisms raised against the Durham Rule that it is too lenient in letting those with mental illness walk free of charges has led to the U.S. no longer using it except for in the state of New Hampshire where more restrictions and the burden of proof have been added to it.

Proposed alternative definitions for defining insanity in the law

In "The Moral Basis of the Insanity Defense" author Richard J. Bonnie proposes a test of legal insanity that goes as follows: "Defense of [insanity] [nonresponsibility due to mental disease].

A. A person charged with a criminal offense shall be found [not guilty by reason of insanity] if he proves, by the greater weight of the evidence, that as a result of mental disease or mental retardation, he was unable to appreciate the wrongfulness of his conduct at the time of the offense.

B. As used in this section the term mental disease or mental retardation include only those severely abnormal mental conditions that grossly and demonstrably impair a person's perception or understanding of reality…" (Bonnie, p. 197).

In other words, Bonnie is using mental disease / mental retardation as a standard for the type of mental illness that will be defended under his definition; his way of defining mental illness focuses on conditions which severely affect one's cognition. Thus, this way of defining insanity can be restated as: one's mental illness must have affected one's cognition by causing them to become severely deluded in his beliefs of reality, that he couldn't understand that what he was doing was wrong. Furthermore, the author also suggests shifting the burden of proof from the prosecution, as criminal trials usually follow, to the defense; this would mean it would be up to the defense team to prove that the defendant meets the legal requirements of insanity at the time the criminal act was committed and to prove innocence based on that. This proposed way of defining insanity in the law takes elements from the M'Naghten test and the revised version of the Durham Rule, as well as the Model Penal Code (which is another way of defining insanity in the law similar to the M'Naghten based on a belief that the defendant must know the criminality of their conduct). The section A requirement of mental disease resulting in the inability to appreciate the wrongfulness of their conduct is very similar to the M'Naghten requirement of not knowing or understanding the nature of the act they were committing. And the part B requirement is more similar to the Model Penal Code because they are focusing on more severe types of mental disorders, such as schizophrenia, where a person's perception is severely deluded. This way of defining insanity in the law is an improvement from both the M'Naghten test and Durham Rule because it encompasses the aspect of cognitive ability being impaired by mental illness, which shows that Bonnie is looking for a correlation between the defendant's mental illness and their act(s). However, like the M'Naghten this definition still falls short of accounting for various forms of "nonserious" mental disorders, such as depression, and still only focuses on severe forms of mental illness; because of this I believe that more work needs to be done so that nonserious mental illnesses are covered by an insanity defense too because they can play a major affective role in one's behavior.

This next proposed definition introduces the term "psychotic delusions" which is a term that describes the way one's mind or cognition is affected by their mental conditions, because of this, this is the definition I believe to be superior. The proposed definition is posed in John Whelan Jr.'s, "Psychotic Delusion and the Insanity Defense" where he introduces what he calls the "Psychotic Delusion Defense." The definition for this defense proceeds as follows:
No one may be found guilty of an intentional offense (though that person may be found guilty of negligence), if
(a) that person was led to perform the act for which he's accused by psychotic delusions and if
(b) those psychotic delusions so dominated his mind at the time he acted that either
(i) he was mistaken in significant respects about what he was doing or
(ii) he didn't know (and wasn't negligent in failing to know) that what he was doing was illegal or (iii) if he did know that what he was doing was illegal, he was unable, because his delusions so dominated his mind, to take proper account of that fact (Whelan, p. 42).

Under this definition for insanity in the law, a person may not be held criminally liable if they meet the criterion listed above, however they may be found guilty of negligence. This is my preferred version of defining insanity in the law because it raises the idea of psychotic delusions which is able to encompass a wide variety of mental illnesses (even those deemed "not severe" such as depression and anxiety). Additionally, it accounts for various ways that those delusions may affect one's mind and cognitive ability such as not knowing what you are doing, knowing what you are doing but not knowing it is wrong or illegal, and knowing that what you are doing is illegal but not possessing the ability to do otherwise and/ or understand exactly what that means. Like the Durham Rule, this way of defining insanity takes into account various forms of mental illness and does not narrow the insanity defense down to only defend those with very serious mental health issues such as schizophrenia (Whelan, pp. 42-43). Yet it also incorporates the aspect of the offender not knowing what he was doing, or not knowing that what he was doing was wrong such as the way the M'Naghten test requires. But most importantly the inclusion of the "psychotic delusion" requirement of this definition acts in a way to limit the cases where an offender who suffers from mental illness can use an insanity plea. This distinction sets this definition apart from the rest because it emphasizes the importance that the offender's mental illness must play a specific role in effecting their cognitive ability during the committing of an act in order for their mental illness to be sufficient for them to plea insane.

Psychotic Delu sion Req uirement

At this point you may be wondering, what exactly is a psychotic delusion? In short, a psychotic delusion is a false belief that seemingly provides reasoning for your actions; it is important to note that these beliefs only provide "reason" to those who suffer from said psychotic delusion (Whelan, p. 37). So how do we distinguish psychotic delusions from any other belief? Whelan suggests four differences between "regular" beliefs and psychotic delusions. First, he claims that psychotic delusions can be altered or will disappear altogether with the introduction of antipsychotic medication whereas the rest of our beliefs will persist (Whelan, p. 38). He explains that this is because our regular beliefs, even those that are not well formed, are products of reason which we validate through information and inference. Whereas psychotic delusions are not products of reason and cannot be altered by the introduction of information, they can only be altered with antipsychotic medication (Whelan, pp. 38-39).

Second, Whelan states that unlike our other beliefs, psychotic delusions cannot arise through persuasion nor could they be discussed in a persuasive manner to influence others (Whelan, p. 39). Because these beliefs arise from a deluded mind, it follows that psychotic delusions are not formed through convincing discussion nor could it be formed this way for someone else. In the case that these beliefs were to be communicated to others they would seem outrageous or ridiculous and would not be taken seriously by the audience. Since there is no way of communicating psychotic delusions Whelan claims that they can never be "current in culture" or believed by a large number of people (Whelan, p. 39).

Third, those who suffer from psychotic delusions will not be able to process objections toward their belief nor will they have any idea of how to respond to those objections (Whelan, pp. 39-40). This goes back to the first reason involving the fact

that these beliefs are not formed through reason and information. Since psychotic delusions do not arise in this way, the person who suffers from them will lack the ability to explore any outside criticism of their beliefs. Additionally, they will not be able to provide any reasoning toward responding to said criticism; to them their belief(s) will just remain self-evident.

Fourth, while psychotic delusions may at times seem like just uninformed beliefs, they differ in the sense that uniformed beliefs arise from mistake in reasoning and psychotic delusions do not (Whelan, p. 40). Whelan explains that uninformed beliefs arise from various mistakes whether it be mistakes in reasoning, other false beliefs, or mistakes in inference; thus, these beliefs can be corrected later. Psychotic delusions do not arise due to any mistake listed above nor can they be corrected (except with antipsychotics as discussed earlier), so it is evident that something else must be happening with this person's cognition.

Objection an d Resp onse

A critic of the "Psychotic Delusion and the Insanity Defense" might claim that this defense does not adequately account for all forms of mental illness, in fact it only accounts for cognitive disorders and not mood disorders; so, one of the main objectives of broadening the definition of insanity in the law to encompass all forms of mental disorders has not been accomplished. Specifically, the critic questions how, if at all, someone with a mood disorder such as depression, anxiety, or mania, would be protected under this way of defining insanity in the law. If there is no way that these forms of mental disorders can be protected under the insanity defense, the argument is insufficient.

In response to the claim posed in the objection that some forms of mental illness, in particular mood disorders, are not protected under the "Psychotic Delusion and the Insanity Defense," I would like to propose a revision of the definition that would sufficiently? broaden it to allow for the defense of mood disorders. Before introducing the new, revised version of the defense, I would like to first establish an understanding of the affective role mood disorders have on an individual who suffers from them. Mood disorders differ from other forms of mental illness, such as schizophrenia for example, because they do not necessarily involve one's cognition to be impaired or deluded. Instead, mood disorders play an affective role which result in a disturbance of one's mood or emotion(s). Initially it may be thought that a disturbance in mood and emotions is not sufficient to be deemed insane and not legally liable for crimes however, it is important to note the affective role that mood disorders can have on a person's action / inaction that would cause them to not be considered a responsible agent due to their lacking the necessary emotional landscape that is required for an agent to be responsible.

To enlighten this point, I will raise an example of a depressed mother who lets her infant die due to her mood disorder. Consider the case of a woman who is suffering from severe postpartum depression. Her depression affects her in a way that she does not have the energy, nor does she care, to even get out of bed each morning. Because of her inability to get out of bed, she neglects to take proper care of her baby, which leads to the death of the infant. This woman was not deluded as the proposed definition of insanity suggests is required to be eligible for the defense, yet it is clear that her mental disorder played a specific role in her commissioning of the crime, specifically it played an affective role that

caused her inability to properly care for her child. This woman was not deluded, she most likely knew the difference between right and wrong, but because of the role that her mental illness played in the commission of the crime, I am urged to say that she is not responsible for the death of her infant because her mood disorder prevented her from participating in the care necessary for sustaining an infant's life.

In light of this discovery, I will now propose the revised definition of the psychotic delusion and the insanity defense which I will call "Affective and Psychotic Delusion Defense of Insanity." The new definition will proceed as follows:

No one may be found guilty of an intentional offense (though that person may be found guilty of negligence), if
(a) he suffered from a mood disorder whose affective role created a disturbance of his mood or emotion, causing his action / inaction to result in the commission of a crime OR
(b)that person was led to perform the act for which he's accused by psychotic delusions and if
(c) those psychotic delusions so dominated his mind at the time he acted that either
(i) he was mistaken in significant respects about what he was doing or
(ii) he didn't know (and wasn't negligent in failing to know) that what he was doing was illegal or (iii) if he did know that what he was doing was illegal, he was unable, because his delusions so dominated his mind, to take proper account of that fact (Whelan, p. 42). With this new added component of the definition, namely the new section (a), people with both mood disorders and cognitive disorders will be able to successfully use the insanity defense in court. Note that this new definition now results in two possibilities when using this defense, those possibilities are: 1. you can use the section (a) requirement alone to be found affectively insane or 2. you can use the rest of the definition (b), (c), and one of the 3 subsections to be found insane based on psychotic delusions. This new definition should sufficiently answer the objection posed by a critic because now the definition of insanity will have been broadened enough to account for all forms of mental disorders. Additionally, this definition has kept the exception that would allow for the defendant to possibly be found guilty of negligence. So, in the case of the depressed mother who let her infant die; she may be able to successfully use the insanity defense to not be found guilty of murder, but the courts can possibly find her guilty of being negligent. Thus, this definition both successfully broadens the insanity defense, while simultaneously limiting it.

Andrea Yates Case Example

Next, in order to gain a better understanding of the way that the criticized definitions of insanity and the way the new defended definition of insanity will actually work in the courts, I want to introduce the case of Andrea Yates as an example. In 2001 in Clearlake, Texas's Andrea Yates drowned her five children one by one in the bathroom of their home. When asked why she did this to her children, she answered that she needed to save them from being doomed to eternal damnation. Yates believed that she had the "mark of the beast" 666 burned onto her own scalp and that because of this she was causing her children to be damned. Prior to this incident, in 1999 Yates had sought psychiatric help and had been diagnosed with major depressive disorder, she was then prescribed the antidepressant medication Trazadone. Later that same year Yates attempted to commit

suicide and was committed to a hospital where she was then prescribed the antipsychotic medication Haldol (CNN).

To better understand the ways that the criticized views would assess a case involving an insanity plea I will use Yates' case as an example. Under the M'Naghten test they (the courts) would question whether or not Yates knew that killing her children was illegal. In this case the defendant did know that killing her children was illegal, but she believed that she would be saving them from an eternal damnation in hell. Since Yates knew that murdering her children was illegal, under the M'Naghten test she would be found sane and therefore guilty of her charges. On the contrary, under the Durham Rule they would have a different worry that would cause them to question whether or not Yates suffered from mental illness. The answer would be yes, Yates was clearly mentally ill suffering from depression and (perhaps) paranoid schizophrenia, and the killing of her children were a result of reasons associated with her mental illness (Whelan, p. 27). Therefore, under the Durham Rule Yates would be found not guilty by reason of insanity.

Now let's assess this case using the Affective and Psychotic Delusion Defense of Insanity. It is clear that Andrea Yates suffered from psychotic delusions, her false belief of eternal damnation, at the time she committed the act (satisfying this definitions 'c' requirement). Yates was led to perform those acts based on psychotic delusions (satisfying the definitions 'b' requirement). And while Yates knew that drowning her children was illegal, she was unable to take account of that fact because of the affect that her psychotic delusions had on her mind (satisfying one of the three subsection requirements, namely the third option, to prove insanity under this definition). Therefore, under this proposed way of defining insanity in the law Yates would be found not guilty by reason of insanity due to her psychotic delusions.

Concluding Remarks

This paper has attempted to show that two of the popular ways of defining insanity in the law, namely the M'Naghten test and the Durham Rule, ultimately fail because they do not adequately define mental illness, nor do they account for the ways in which mental conditions affect one's cognitive ability. I have shown that the M'Naghten is flawed in its definition because it is focused on whether or not somebody narrowly knew the nature of the act they were committing, and in doing so, causes the M'Naghten to fail to account for various forms of mental illnesses. I have also shown that the Durham Rule is flawed in its definition because it is too lenient and supposes that anyone who suffers from a mental illness should not be held legally liable for their acts. This is flawed because mental illness does not always play a role in the committing of an act and in the case where it does, that is when one should be eligible for an insanity defense. Additionally, I have supported an alternate way of defining insanity in the law, namely John Whelan Jr.'s "Psychotic Delusion and the Insanity Defense." But in light of an objection which points out the fact that this definition does not offer a defense for mood disorders, I have revised the definition and renamed it Affective and Psychotic Delusion Defense of Insanity so that it may encompass both mood and psychotic disorders. I explained that this would be my ideal definition because it is able to encompass the various ways that mental illness can affect one's mind both psychotically and affectively while emphasizing that one's mental disorder must play a

specific role in the action / inaction that results in the commission of a crime.

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Sandoval   **Photonic Crystals Behavior in Guiding Structures**
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Abstract

Hyperbolic Metamaterials (HMMs) are multilayer structures that consist of propagating guiding modes of high effective refractive index (ERI) and nanolayers of alternating conducting and dielectric materials. These modes result in the interaction combination of Surface Plasmon Polaritons (SPPs) and Long-Range Surface Plasmon Polaritons (LRSPPs). HMMs have the potential to be used in biomedical sensors as highly sensitive biosensors. We are studying the behavior of photonic crystals in guiding structures. Our interest in working with photonic crystals is due to their very high effective refractive index (ERI) of modes propagating within these structures. Photonic crystals consist of photonic bands that prevent light from propagating in a specific direction. We are using a one-dimensional (1D) diffraction grating to create this photonic band. The interaction between the diffraction grating and the guiding modes leads to the creation of the "total external effect" when all radiation reflects from the surface of a guiding structure.

Major Objectives

We are studying the behavior of photonic crystals controlling light in guiding structures and determining which waveguide structure creates a "total external effect." We are calculating the wavelength for the dielectric waveguide and have almost completed the structure for the dielectric waveguide. The other three structures: hyperbolic metamaterial (HMM), Surface Plasmon Polaritons (SPPs) and Long-Range Surface Plasmon Polaritons (LRSPPs) will be constructed and will calculate for wavelength.

Background Research

Our goal of this research is the creation of a cost-effective biosensor system with very high sensitivity. We studied the behavior of photonic crystals in guiding structures. Photonic crystals are low-loss periodic dielectric mediums containing photonic band gaps that prevent light from propagating in a specific direction [1]. Photonic crystals act as a guiding layer for a dielectric waveguide structure and hyperbolic metamaterial structures to guide light in a multilayer structure. Dielectric waveguide structures consist of three layers, a cover layer, a waveguide layer, and a substrate layer. In dielectric waveguides, if the waveguide layer refractive index is greater than the cover layer and the substrate layer refractive index, light sent into the structure will be propagated within the waveguide layer. Photonic crystals in a dielectric waveguide act as a medium to propagate light throughout the waveguide layer. Hyperbolic metamaterials (HMM) consist of very thin dielectric and metal multilayer structures that can achieve high effective refractive indexes (ERI) [2]. Photonic crystals as dielectric layers in a hyperbolic metamaterial provide high effective refractive indices. The more layers there are in hyperbolic metamaterial (HMM) structure, the greater the refractive index [3]. Surface Plasmon Polaritons (SPPs) are a type of electromagnetic wave that occurs when light is propagating on the metal-dielectric boundary [3]. The structure consists of a cover layer (water), Metal film (gold), and substrate (glass).

The light propagation length for SPP modes is limited due to the heating of the metal film by the electromagnetic wave. Long-Range Surface Plasmon Polaritons (LRSPPs) are like SSPs but have light propagate on the metal-dielectric boundary for a longer range. LRSPPs add a dielectric layer on the top of the metal layer with the same refractive index to help light propagate for a loner range. Adding a dielectric layer leads to electromagnetic field redistribution and the electromagnetic field is in the dielectric layer rather than metal film to avoids metal layer heating [3]. We picked these structures to see if they can achieve a "total external effect".

Methods

Our method of making these waveguide structures is using COMSOL Multiphysics, HARM and Mathematica. COMSOL Multiphysics is computer software used to create waveguide structures and generate data from that structure. All the structures are simulated on COMSOL Multiphysics to generate a field distribution. The structures parameters are all Transverse Magnetic (TM) polarized light consists of a wavelength of 1550 and a cover layer of 100 nm. The dielectric waveguide consists of the cover layer (water), the 600 nm waveguide layer (photonic crystal), and BK7 glass as a substrate. HMM structure consists of 26 layers of Au and Photonic Crystal, each with a thickness of 7.5 nm. Also, we are using a one-dimensional (1D) diffraction grating to create the photonic band for the crystal. Our second method called HARM, is an analytical method that calculates the resonance peak for waveguide structures. We used the data from COMSOL Multiphysics of measured reflectance and angle of incidence to generate a resonance peak. We use this to get angles of the reflectance to find our wavelengths. Our third method is Mathematica to calculate the data generated from HARM to convert angles into wavelengths through Bragg's equation. Mathematica is an analytical method that produces plots calculates mathematical formulas and can import data from excel or a text file.

Progress

The progress we have made as of now is that we are diffraction grating the dielectric waveguide structure on COMSOL Multiphysics. The structure and the data we want to calculate for the dielectric waveguide is nearly complete. The code for using Bragg's equation to determine the wavelength needs more polishing. In Mathematica, we want to add plots and graphs to see the wavelengths. The graphs and the data generated from using Bragg's equation will determine whether we achieve a "total external effect" from the structure. Once we have completed the dielectric waveguide structure, we will move on to the other three structures in determining whether they can achieve a "total external effect" with the use of photonic crystals.

Hurdles

One of the biggest hurdles for me is whether I can continue to work on this research this summer. I got accepted the Summer REU at USC and I do not know whether I will be able to do both the research assigned to me at the Summer REU and the research I still need to complete here at Cal Poly Pomona. The summer REU for USC starts June 14th and ends August 6th. I can work on my research at Cal Poly for the first three week of the summer break before the start of the Summer REU. One good news is my partner on the project is still going to stick around unit the research is complete. I will be talking with my mentor and with Dr. Dong after finals week to see what the best approach for this situation would be.

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Schärfenstein-Montgomery Reconfigurable S-Curve Motion Controller

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Abstract

Many of the industry's motion controllers use non-reconfigurable motion profiles, which are often limited to modeling a trapezoidal profile with a linear acceleration/ deceleration phase or an s-curve profile jerk, the derivative of acceleration. Higher-order velocity derivatives are rarely explored to achieve a customized "smoothness" of the motion profile, desired in many real-world applications and robotics systems. The lack of reconfigurability and open-source platforms makes customizing control expensive and the design process redundant for different applications. This paper will provide a cheap, open-source, and reconfigurable solution that generates motion profiles for a wide range of precision levels. It first introduces the concept of polynomial s-curve trajectory and then explores two different categories of velocity s-curve profiling approaches. Performance evaluations of the motion profile are done both mathematically and empirically. This paper offers an overview of how the motion profile methodology can be applied to a closed-loop control system of any kind with existing open-source PID feedback of the specific application. Moreover, a quadrotor demo for autonomous flight is developed to illustrate the higher-order motion profile's usefulness and the algorithm's reconfigurability.

Major Objectives

This project aims at providing an open-source, portable and reconfigurable solution to generate motion profiles for a wide range of precision levels that can be executed on a small and cheap single-board computer such as a Raspberry Pi. In this paper, the word "smoothness" is used to refer to a stabler motion with less transient vibrations. This current work can potentially be the next phase of drone technology, designing a new mechanism that would allow people to charge drones' on-fly and physically docking for achieving high-data-rate while moving data from drone to another in the same swarm.

Nowadays, many motion control systems are often customized based on the application, in both industrial and commercial use cases. Most motion controllers used for massive assembly lines in industries such as food, manufacturing, and construction have a unique closed-sourced motion profile designed and calibrated to satisfy the criterion of its application. It is to reuse an existing controller in applications other than what it was designed for, for two significant reasons. Firstly, there may be considerable differences in the movements in different applications, such that they require motion profiles of completely different precision levels. Secondly, as a common standard for product development, only a limited number of essential hardware and software interfaces are provided for users. At the same time, most of the technical details remain fixed and closed-sourced. Therefore, a lack of reconfigurability and open-source platforms makes the price of customizing control expensive and the design process redundant for different applications.

In some motion control applications such as assembly lines for package delivery, the motion is simple, repetitive, and tolerable of noise, which is why one may argue even a trapezoidal profile with a linear acceleration/deceleration phase can produce such a movement with limitations on only maximum velocity and acceleration. However, in other cases, such as those that involve movement of liquid, an s-curve profile of jerk (the derivative of acceleration) may be necessary to avoid the liquid being spilled over due to residual vibration caused by infinite jerk preserved in the motion. With the rise of Artificial Intelligence and the need to develop autonomous systems in Robotics, stability, and precision in motion become critical. They can significantly affect a robot's significant tasks, such as object detection and tracking. In such cases, higher-order derivatives of velocity beyond jerk need to be considered in the simulation of the motion profile to achieve the desired smoothness in movements.

LITERATURE REVIEW

A. Jerk & Higher Order Derivatives of Velocity

1. Triangular & Trapezoidal Velocity Profile

Position control is usually achieved using a position controller and a profile generator. The profile generator produces the desired position trajectory from a position reference and predefined profiles. Motion control is also referred to as time-based position control. The profile generator calculates critical times when fundamental value changes according to the predefined profiles and position reference [1]. This paper will use the terms position profile and displacement profile interchangeably, as well as use the term motion profile to refer to the class of all profiles, including position, velocity, acceleration, and higher-order derivatives being simulated. Intuitively, one has the reason to believe that a precise position control can be achieved by controlling the velocity and acceleration in time. Our body can feel the change of velocity i.e. acceleration, brought about by force exerted by an object on our body. To minimize the biomechanical effects of sudden changes in velocity on the human body, most transportation devices are designed to reduce acceleration as much as reasonably practicable [2]. In general, in any motion control application, the motion profile has a desired "smoothness" which, when achieved, will only produce a limited and acceptable amount of peak and total residual vibration.

Figure 1 below shows a triangular and a trapezoidal velocity profile simulated from modulating the acceleration profile with a piecewise function, which is a square wave. When the duty cycle is 100%, meaning the continuous acceleration signal is never at rest, the velocity curve v(t) obtained is a triangular function as shown below:

$$v(t) = \int_T a(t)dt = \begin{cases} \int_t A_{max}dt = A_{max}t & t \le \frac{t_c}{2} \\ \int_t -A_{max}dt + \int_0^{\frac{t_c}{2}} A_{max}dt = -A_{max}t + \frac{A_{max}t_c}{2} & t > \frac{t_c}{2} \end{cases}$$

Similarly, when the duty cycle is less than 100%, meaning that the signal stays at zero for some time between any two rectangular pulses, the velocity profile v(t) is trapezoidal.

$$v(t) = \int_T a(t)dt = \begin{cases} \int_t A_{max}dt = A_{max}t & t \leq t_v \\ \int_0^{t_v} A_{max}dt = A_{max}t_v & t_v < t \leq t_c - t_v \\ \int_{t_c - t_v}^{t_c} -A_{max}dt + \int_0^{t_v} A_{max}dt = -A_{max}t + A_{max}t_v & t_v < t \leq t_c - t_v \end{cases}$$
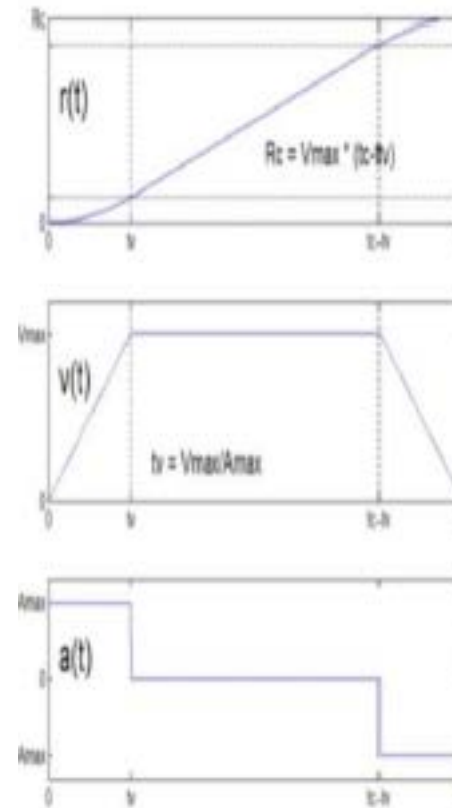

Fig. 1. Velocity & position profile when acceleration is set to a square wave [3]

From Figure 1, you can observe that the trapezoidal profile has a smaller peak velocity and a more extended time where the velocity remains constant. The velocity is never constant in the triangular profile. An external force is applied to the object throughout the movement, which may not be the key factor that causes more vibration. Still, it will undoubtedly require additional and unnecessary power to be supplied to generate the force. Therefore, the acceleration profiles are almost never stimulated with square waves above 50% duty cycles, and triangular velocity curves are rarely used in practice. Also, there are similar observations from existing motion profile literature with piecewise functions containing waveforms other than square waves. In most cases, there are always intervals of zeros between intervals of non-zero signals when a profile of any higher-order derivative(s) of velocity is simulated because of power consumption reasons and the practical desire to keep velocity stable most of the time.

2. Jerk & S-curve Velocity Profile

Jerk is uniformly defined by the ISO (the International Organization for Standardization) as the derivative of acceleration or the third derivative of displacement in 1990 [4]. According to Eager in the European Journal of Physics, acceleration without a jerk is just a consequence of static load. Jerk is felt like a change in force; jerk can be felt as an increasing or de- creasing force on the body [2]. Immediate onset of acceleration has a large jerk that can be detrimental to equipment, result in loud bangs, and be uncomfortable for riders in transportation systems [3]. There are many situations where we attempt to control jerk in the motions. For instance, an experienced driver accelerates smoothly; a
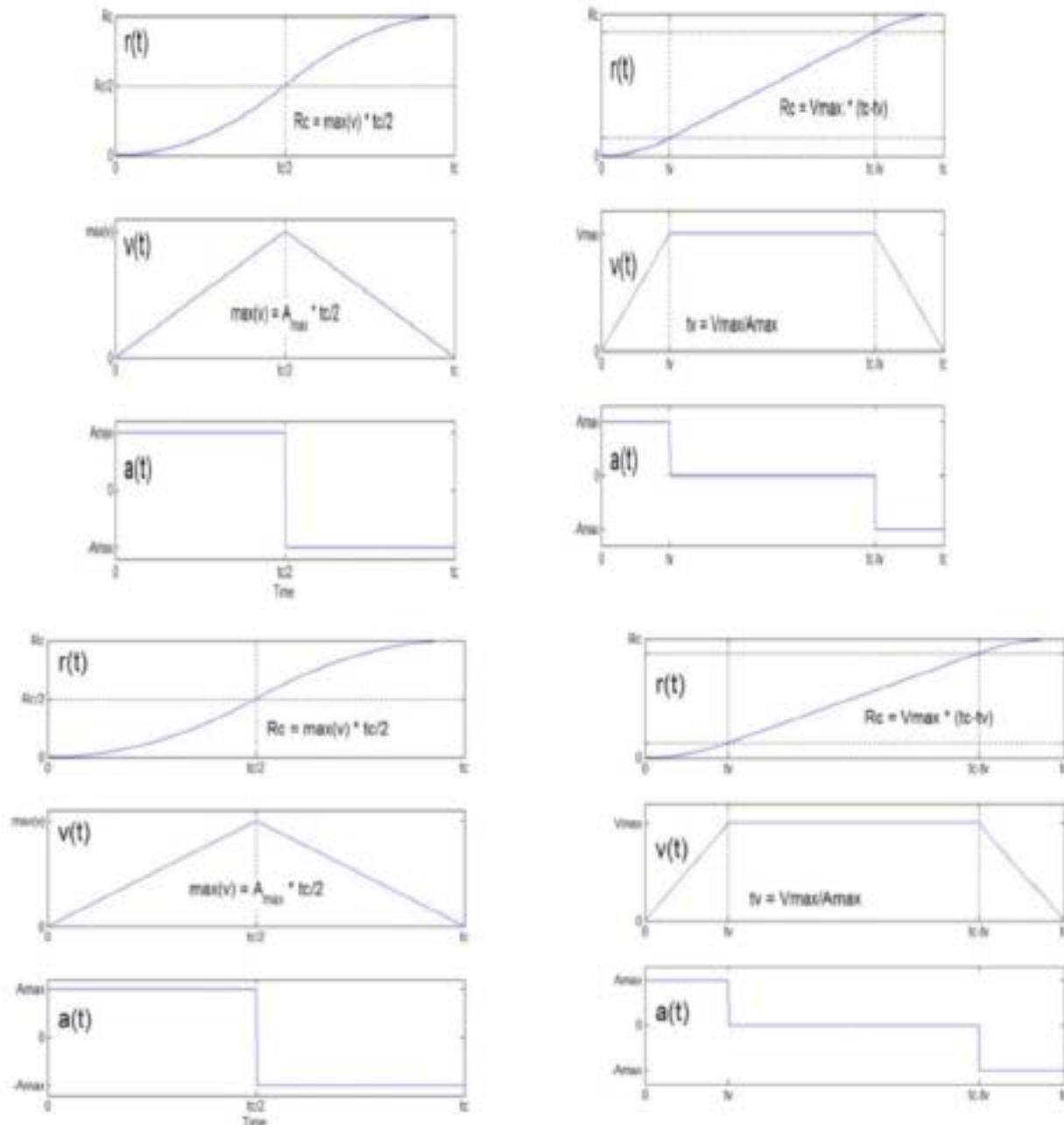
clothoid (also referred to as an Euler spiral) exit on the highway is implemented. Change in the linear and angular acceleration of the car is not abrupt [2].

As shown in Figure 2A, the resulting velocity s-curve has smooth, differentiable corners instead of sharp, non-differentiable corners, namely at t = tv and t = tc − tv in Figure 1. These two non-differentiable points in the trapezoidal profile are the cause of the residual vibrations because acceleration has a vertical slope, which indicates an infinite jerk at these points. By simulating jerk profiles, we cannot limit the amount of jerk to be finite throughout the profile but precisely control its value, which can help customize the final displacement profile. Keep in mind that the infinite jerk issues introduced by these sharp corners have directly resulted from the integration of square waves, which may be eliminated by using another waveform covered in the following subsection.
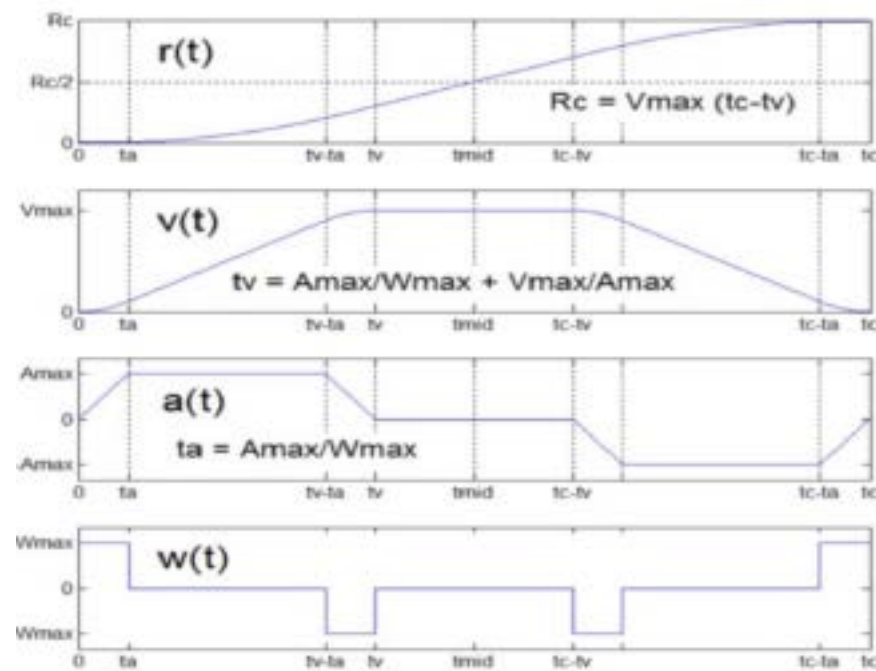
Fig. 2A. Motion profiles using square wave as jerk [3]

We can generalize the argument that to ramp up/down jerk smoothly, we need to make sure the jerk's derivative does not diverge to infinity at any time; namely, its profile is differentiable everywhere during the motion. There are no common names for derivatives of displacement higher than third as they are rarely explored. Snap, crackle, and pop are not official but have been used respectively for the fourth, fifth, and sixth derivatives of displacement [3]. Kim's team has empirically shown the advantage of using higher-order s-curves in Figure 2B.
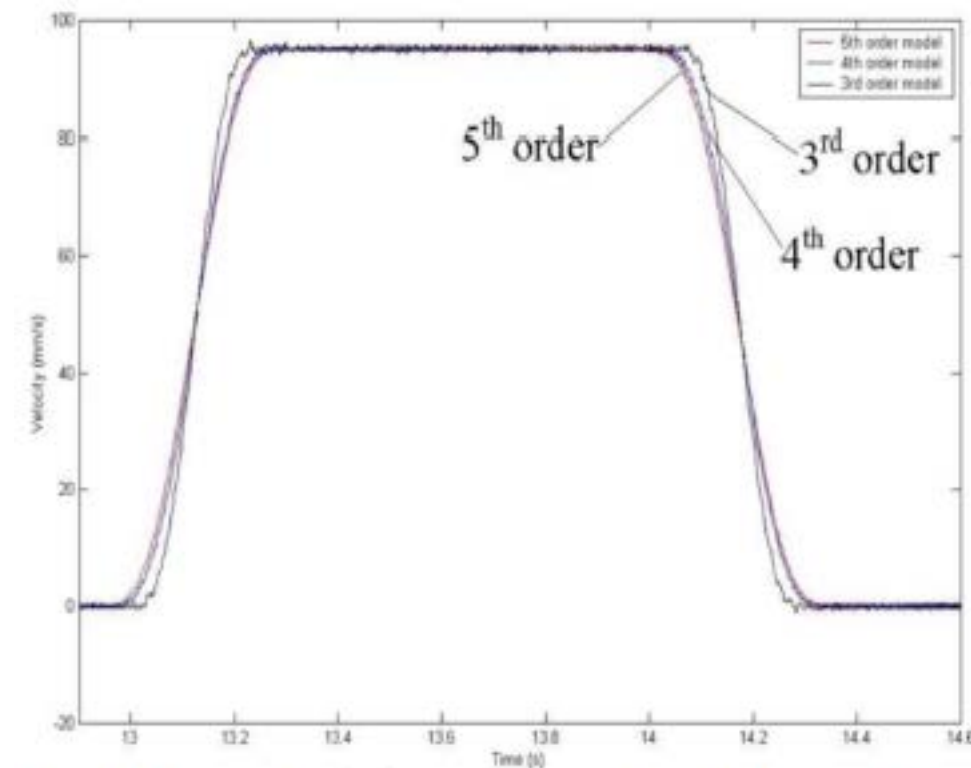
Fig. 2B. Velocity profiles comparison between simulation of higher order derivatives with square waves [6]

B. Trajectory as a Piecewise

1. Square Wave Simulation of Higher Order Profiles

Notice that there is an underlying assumption made in the motion profiles and examples given so far, namely, a square wave is used for the highest order derivative we choose to simulate for the motion profiles, regardless of the difference in spacing between any two pulses. Piecewise square wave is indeed very commonly used. For example, Erkorkmaz and Altintas proposed an algorithm in 2001 using jerk-limited speed control to generate a time-optimal trajectory, which provides continuous position, speed, and acceleration profiles [5]. This algorithm is meant to be used for speed profile only under the context of the paper. As shown in Figure 3, this algorithm is more generic than the ones shown previously as it takes in the length of each interval from T0 to T7, and the magnitude J1 to J7 of each non-zero interval of the square wave as inputs from the users.
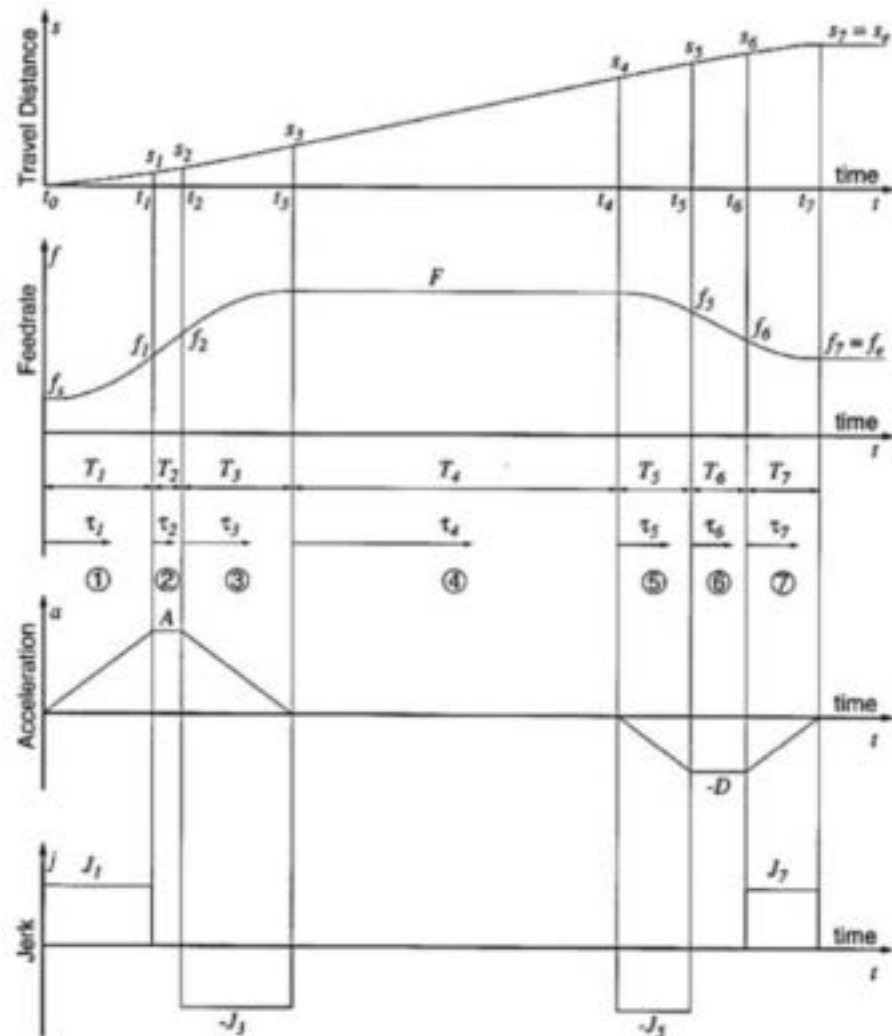
Fig. 3. Square wave jerk with customized magnitude and duration [5]

Moreover, there are already existing efforts towards reconfigurability using square wave simulations of higher-order profiles. Kim et al. [6] generalized the model of polynomial s-curve motion profiles in a recursive form, proposing a general algorithm to design s-curve trajectories with jerk bounded and time-optimal consideration. Namely, if Mn is the nth order s-curve model, it can be represented by a piecewise function using Mn−1 as the following:

$$M_n = \begin{cases} M_{n-1} & t_0 \leq t \leq t_{2^{n-1}-1} \\ 0 & t_{2^{n-1}-1} \leq t \leq t_{2^{n-1}} \\ -M_{n-1} & t_{2^{n-1}} \leq t \leq t_{2^n-1} \end{cases}$$

For example, the number of square wave segments needed for a 3rd order jerk profile is 7 as shown in Figure 2, which means the 3rd order profile M3 will be the profile in Figure 4 from t0 to t7. Then, M4 will be the profile in Figure 4 from t0 to t15. Every time the order increases by 1, we essentially duplicate the current square wave and negate the signal after an additional rest period. Therefore, the total number of segments of an nth order profile is (2n−1 − 1) × 2 + 1 = 2n − 1. Note that in this paper, we will also use the same convention, which denotes the velocity profile as the 1st order profile, acceleration as the 2nd order, etc.
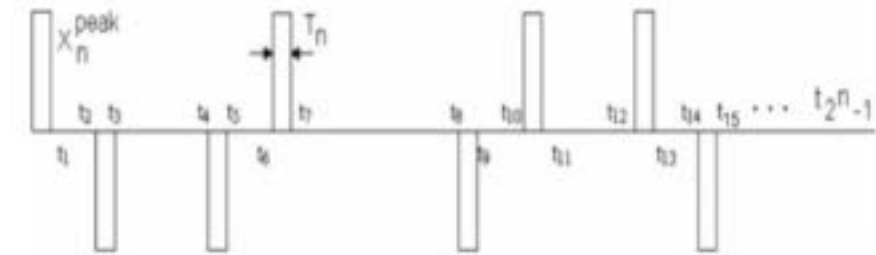
Fig 4: Template of the nth order s-curve model proposed in [6]

2. Sine Wave Simulation of Higher Order Profiles

In the s-curve algorithm proposed by Kombarov's team for high-speed equipment control tasks [7], the authors applied the sin2 function to a linear function of t to form the feed change profile acceleration-deceleration process. Since they adopted the model of jerk pro- file first introduced by Sosonkin in 2005, namely FJ1(t) = sin2(ωτ(t)), without providing a fully explained reason, we will expand on the motivation behind this design choice. Their design's motion profiles are shown in Figure 5, where F is the feed rate or the velocity. The DJ represents the jerk's derivative, the subscript max stands for the maximum limit for a profile, and the subscript p stands for the maximum achieved quantity for a profile. They also provided two plots shown in Figure 6 of their experiment results, showing how an S-curve acceleration profile effectively reduces jerk in a trapezoidal acceleration profile or simulating a 4th order profile produces less jerk in motion compared to a 3rd order profile.
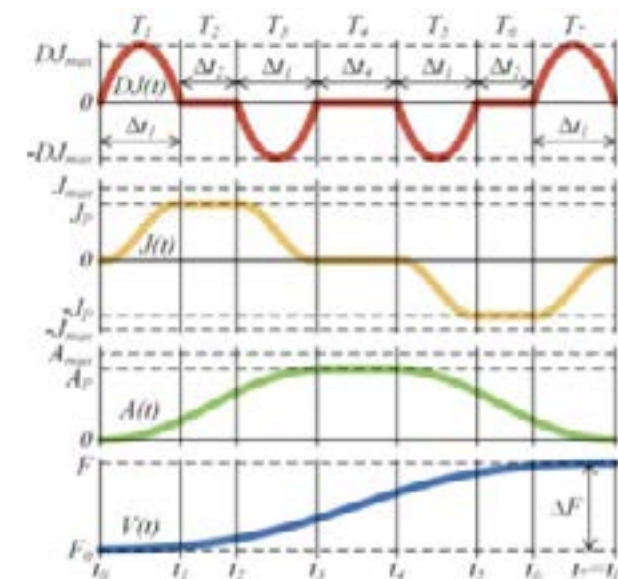

Fig 5: Piecewise profiles using sine waves [7]

Notice that simulating a jerk profile with sin2 of some linear function f(t) is equivalent to modulating snap using a sine wave where f′(t) is a constant, as shown in (1). Another way to think of the sin2 function is that it is a shifted version of the sin function in both the time and magnitude axis, as shown in (2).

$$\frac{d}{dt}\sin^2\big(f(t)\big) = 2\sin\big(f(t)\big)\cos\big(f(t)\big)f'(t) = \sin\big(2f(t)\big)f'(t) \qquad (1)$$

$$\sin^2(n\pi t) = \frac{1}{2}\Big(\sin(2n\pi t - \frac{\pi}{2} + 1)\Big) \quad \forall n \in Z^+ \qquad (2)$$

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Also, the DJ piecewise in Figure 5 provided by Kombarov's team is not an exact representation of what the actual curve looks like; specifically, at the boundary conditions ti, the piecewise should still be differentiable, not the case shown in their plot.

Servo errors during point-to-point motion with using trapezoidal acceleration profile with jerk limited.

Servo errors during point-to-point motion with using S-shape feedrate profile with smoothly-limited jer.k.
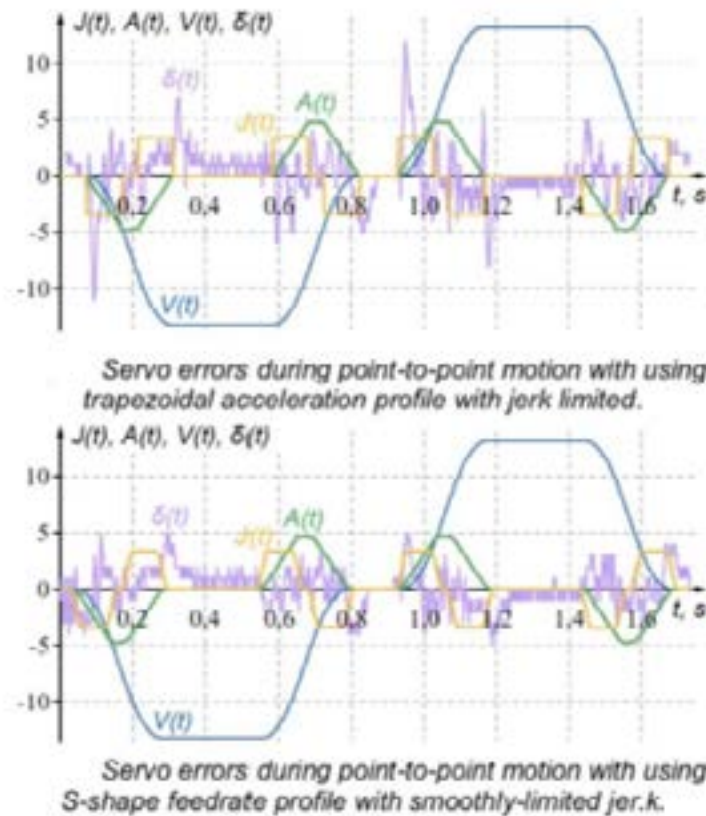
Fig 6: Comparison of jerk between trapezoidal profile and S-curve profile [7]

A better representation of a similar profile is presented in Figure 7 by Kim et al, which has the following definition:

$$j(t) = \begin{cases} \frac{J_{peak}}{2}\big[1 - \sin(\frac{2\pi}{t_J}t + \frac{\pi}{2})\big] & 0 \le t \le t_1 \\ 0 & t_1 \le t \le t_2 \\ -\frac{J_{peak}}{2}\big[1 - \sin(\frac{2\pi}{t_J}(t - t_2) + \frac{\pi}{2})\big] & t_2 \le t \le t_3 \\ 0 & t_3 \le t \le t_4 \\ -\frac{J_{peak}}{2}\big[1 - \sin(\frac{2\pi}{t_J}(t - t_4) + \frac{\pi}{2})\big] & t_4 \le t \le t_5 \\ 0 & t_5 \le t \le t_6 \\ \frac{J_{peak}}{2}\big[1 - \sin(\frac{2\pi}{t_J}(t - t_6) + \frac{\pi}{2})\big] & t_6 \le t \le t_7 \end{cases}$$

The main advantage of this design is that the piecewise function is continuous and differentiable even at the boundary conditions, namely t_1 to t_6 in Figure 7.
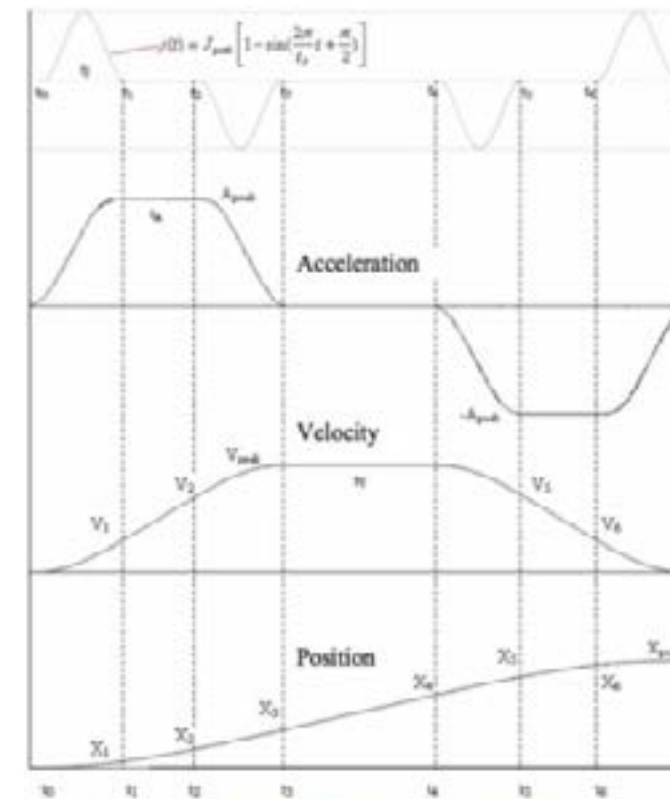
Fig 7. Simulation using Trigonometric Jerk Profile [6]

The left hand and right-hand limits at these points all approach zero, making the function continuous. Simultaneously, there's one uniquely defined slope of 0 at each of these points, making the entire piecewise differentiable, which means that the piecewise function's derivative is limited everywhere in the simulated profile and would not diverge to infinity. In such cases, the purpose of simulating a higher-order profile is no longer to avoid

exploding derivatives and ramp up the following highest-order profile smoothly but to precisely customize the shape and peak magnitude of the higher-order profile. As a result of Kim's experiment, the response of this system with a 3rd order trigonometric jerk model performs as well as that of the 5th order polynomial model if not better in terms of the final position error of the profiling system. The slight drawback is that there will always be an unknown constant when taking the indefinite integral, which needs to be calculated using the corresponding interval's boundary conditions. Doing multiple integrations from a higher-order profile to get the velocity and displacement profile will accumulate additional terms, whose order also gathers every integration, which is a major issue for motion profiling through integration of higher-order piecewise functions for both square waves and sinusoidal waves where the analytical form for some intervals will consist of some high order polynomials with excessive terms.
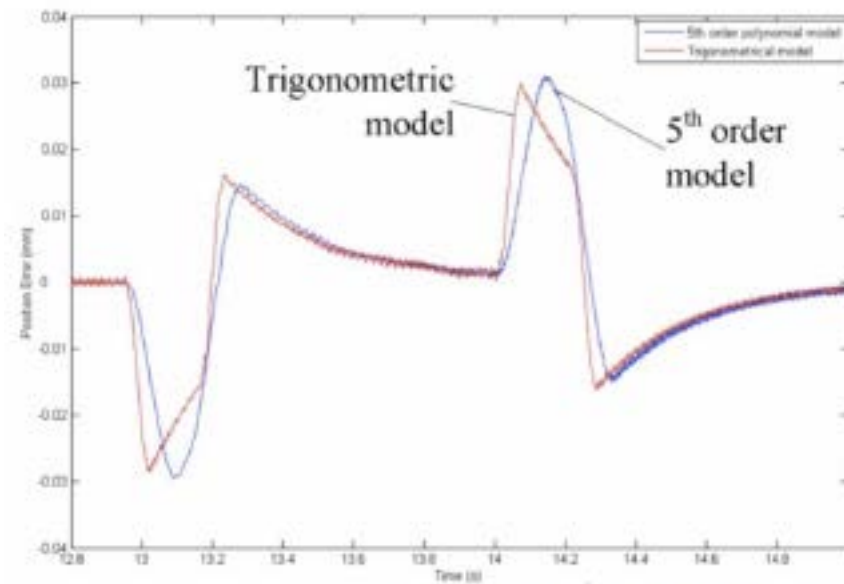
Fig 8: Comparison of position errors [6]

C. Trajectory as a Polynomial
        The other well-established approach to s-curve position profile formulation is finding the solution to a predefined objective function related to higher-order derivatives of velocity, which often has a unique solution defined by a polynomial. We reviewed the Minimum Jerk Trajectory, generalized it to higher orders, and compared it to the Piecewise Trajectory covered in Section 2B.

        Hogan stated in 1984 that maximizing the smoothness (of a trajectory) may be modeled by minimizing the mean-square jerk based on experimental observations. For a particular trajectory x(t) that starts at time ti and ends at time tf, the criterion function is defined as follows:

$$H(x(t)) = \int_{t_i}^{t_f} \frac{(x(t))^2}{2} dt$$

which can be minimized subject to constraints imposed by the physical system [9]. Hogan used a calculus of variations, which finds where the minimum of the derivative of the function concerning a small perturbation equals zero. Hogan proved that the analytical solution can be derived The differential equation x(6) = 0 has the general solution of a 5th order polynomial, namely x(t) = a0 + a1t + a2t2 + a3t3 + a4t4 + a5t5, whose coefficients a0 to a5 can be solved with the set of boundary conditions x(0) = 0, x'(0) = 0 and x''(0) = 0. Similarly, suppose the objective function is defined with higher-order derivatives of velocity. In that case, we can use the same method to find the general solution in a higher-order polynomial.

Methods/Results

        One of this paper's primary goals is to design a systematic way of generating motion profiles with a wide range of precision levels for reconfigurability at a relatively low cost. The more parameters users are allowed to modify, the more reconfigurability they can exploit for different applications. However, reconfigurability sometimes comes at the expense of the system's robustness and extra resource utilization. Therefore, it is essential for us to clearly define our open-loop system, inputs, and outputs before developing different approaches to generate the profiles.

        Comparing the two trajectory simulation approaches from the previous sections, in order to generate a smooth motion, simulations of a piecewise polynomial gives more reconfigurability and customization than that of a single polynomial. As shown in Fig 9, such a system must take in a signal x with a predetermined length representing the user-defined nth order derivative of the displacement profile and generate the displacement profile by taking the integral of x iteratively.
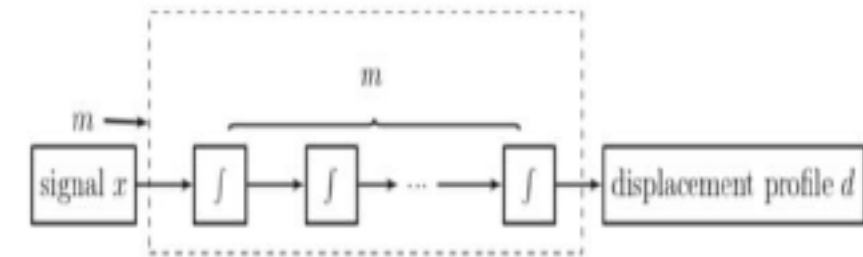

Figure 10: High-level Block Diagram of the General Motion Profile System

Fig 9: High-level Block Diagram of the General Motion Profile System

        Furthermore, we define a set of essential inputs I from users that's common to most applications. By minimizing the size of I, this can reinforce the system's encapsulation and robustness. The most fundamental and universally required inputs in any application are the total displacement D and the time period T of the motion. If they were not known, there would be no guarantee in the correctness of the final profile. Alternatively, users have the option to directly set an upper bound for the maximum velocity Vmax instead of setting T for certain applications with specific limits on the maximum velocity but do not have hard constraints on the time to finish. Notice that to plot the motion profiles, it still needs to derive T eventually from Vmax with some specific conditions covered later. The first major tasks in

reconfigurable piecewise trajectory generation, as shown in Fig 9, is to systematically generate signal x based on D and T, which is non-trivial because the number of intervals for the piecewise profile Vmax is not fixed and indeed dependent on the order m as $2m - 1$ (refer to Fig 1 to 4 as an illustration of more intervals being required for higher orders). Even if we use a method similar to that of Kim et al [6], we need to determine which ones of the potentially many intervals Tn or boundary conditions tn we should allow the user to customize. An even more challenging issue is that there are no trivial ways of knowing whether the higher-order profile x generated would reproduce a displacement profile that matches D exactly before passing it into the series of integrators.

To solve these issues, we first standardize our generating x by allowing users to set two extra parameters: the waveform g of the function at the nonzero intervals and the spacing sp between the first two nonzero intervals. Since limiting to be a square wave or sine wave of unit magnitude, we can represent g with a simple binary form where 0 stands for a square wave and 1 stands for a sine wave. We let the duration of all such intervals be defined by g to be unit length, while $sp \geq$ a unit pulse of g, $p \in Z+$. We will rescale the partially generated piecewise correctly later on. The length of all later intervals of zeros can be determined via recursion, in which case additional characteristics must be defined for x. Recursion is achievable if we can design not only our higher-order profile p to have rotational symmetry about the midpoint T, but all the sub-profiles to observe rotational symmetry about their midpoints T2.

We define our base case, the most fundamental sub-profile, as the signal t0 to t3 in Figure 4, 6, or 7, where our limitations specify $t1 - t0 = t3 - t2 = 1$, and $t2 - t1 = p$. We can already recursively extend the profile to t7 if we know the value of t4 or the length of the zero interval $t4 - t3$ because t4 to t7 is just the negative of t0 to t3. Since it could be too cumbersome to ask users for the spacing between multiple specific nonzero intervals, we only ask for the first interval and double its length every recursive iteration. For instance, $t4 - t3 = 2 \times (t2 - t1) = 2 \times (t2 - t1) = 2p$, etc. Thus, the longest zero interval generated in the last iteration will be $2m-1p$. The profile is more restricted this way in a sense that users can no longer be allowed to generate an asymmetric profile like the one shown in Fig 3, which might be a disadvantage in certain applications when the length of deceleration in the motion profile is required to be different from that of acceleration. However, it does not undermine the purpose of ensuring the smoothness of the motion profile. While users still have plenty of options in profile customization, as they can still indirectly control the length of the intermediate zero intervals by setting the spacing sp in the base case between the first two pulses. Users are required to know less about the physics and the background in motion profile to work with the system. Now, such standardization on the generation of signal x still does not guarantee the correctness of the total time T' and displacement D' of our profile d to match up with the user input D and T. Nonetheless, we can sample d with a preset frequency f, rescale the sampled d0[n] by the ratio rd = DD', and then upsample or downsample d[n] based on the ratio rt = TT' to generate the final sampled displacement profile d[n] which is guaranteed to have reached the correct final/maximum displacement. Fig 10 shows a block diagram of our standardized open loop motion profile system. In summary, our input set $I = \{D, T, Vmax, g, k, p: D, T, Vmax, k \in Z+, T 0 Vmax = 1, g \in \{0, 1\}, p \geq 2, and k \geq 3\}$.

which can be minimized subject to constraints imposed by the physical system [9]. Hogan used a calculus of variations, which finds where the minimum of the derivative of the function concerning a small perturbation equals zero. Hogan proved that the analytical solution can be derived The differential equation $x(6) = 0$ has the general solution of a 5th order polynomial, namely $x(t) = a0 + a1t + a2t2 + a3t3 + a4t4 + a5t5$, whose coefficients a0 to a5 can be solved with the set of boundary conditions $x(0) = 0$, $x'(0) = 0$ and $x''(0) = 0$. Similarly, suppose the objective function is defined with higher-order derivatives of velocity. In that case, we can use the same method to find the general solution in a higher-order polynomial.

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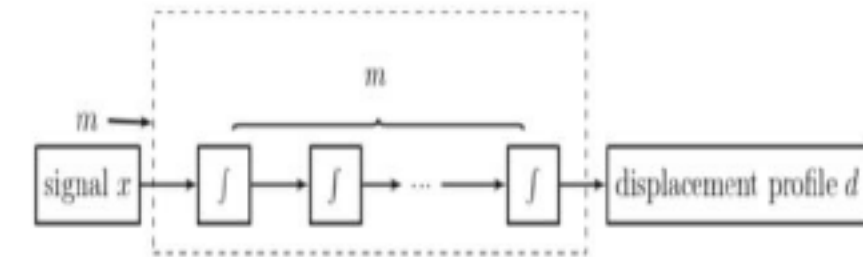

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Fourth Dimensional Analysis

To better visualize our analysis, I created auxiliary Python scripts that enable us to view the theoretical outputs of users' desired inputs in a four-dimensional plane. The desired output parameters such maximum acceleration (Amax) and maximum jerk (Jmax) can be observed in the Z-axis while the inputs of distance, and maximum velocity/time are displayed on the X-Y plane (based on the code version). The input order is represented through color, with each implementation of different order having their unique color as shown in the legend. To enable easier visual inspection, the plots are displayed in mesh form. While this is only for visual analysis, it is important to note that in reality, we are unable to observe non-integer orders.

In the following, you can see how I use fixed max velocity analysis to generate our 4-dimensional plots. I reformatted our initial script to keep our time constant, after which I used max velocity (MaxV), distance, and order as our inputs to generate the various outputs. These outputs are presented on the z-axis for maximum visibility.
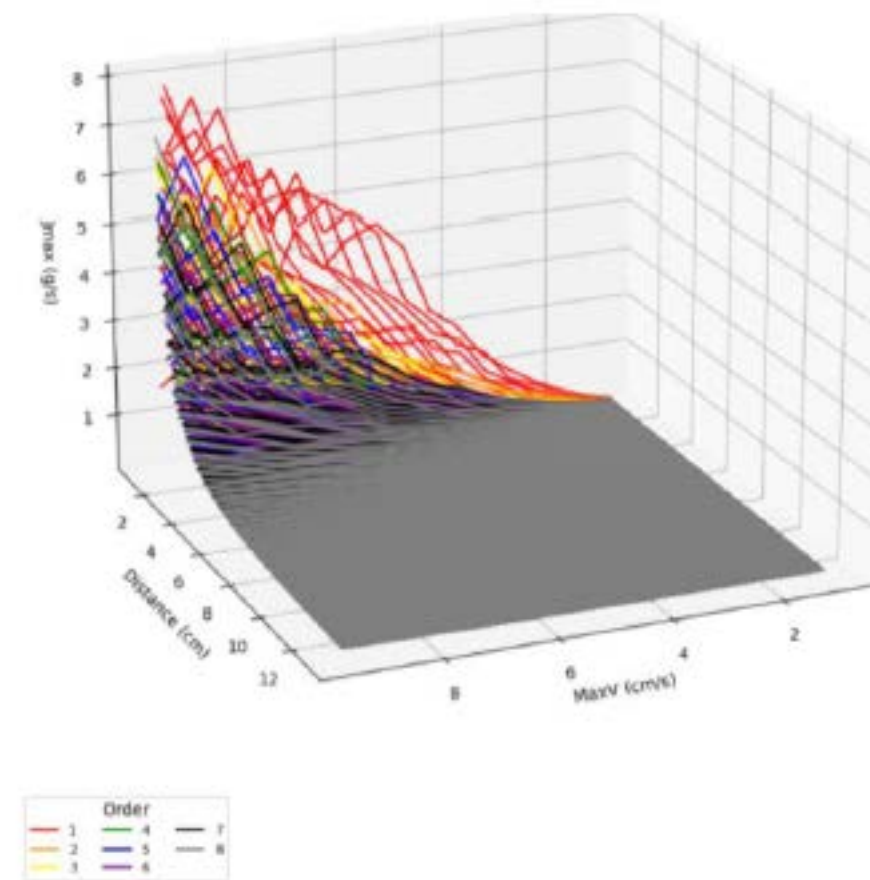

Fig 9: Max Acceleration 4-D plot

Through the generation of these plots, we can analyze the output of max acceleration to see a strong decrease in Amax peak values as order decreases. Showcasing how stability of delivering a payload increases as the S shaped velocity curve smoothes out with each order jump. The slope in Figure 9 is displayed as inconsistent in terms of its gradient, as we see abrupt spikes in its values that create an erratic slope due to higher max velocity at lower

distances. As order increases, the slope is shown to plateau and is more consistent than at the extreme points
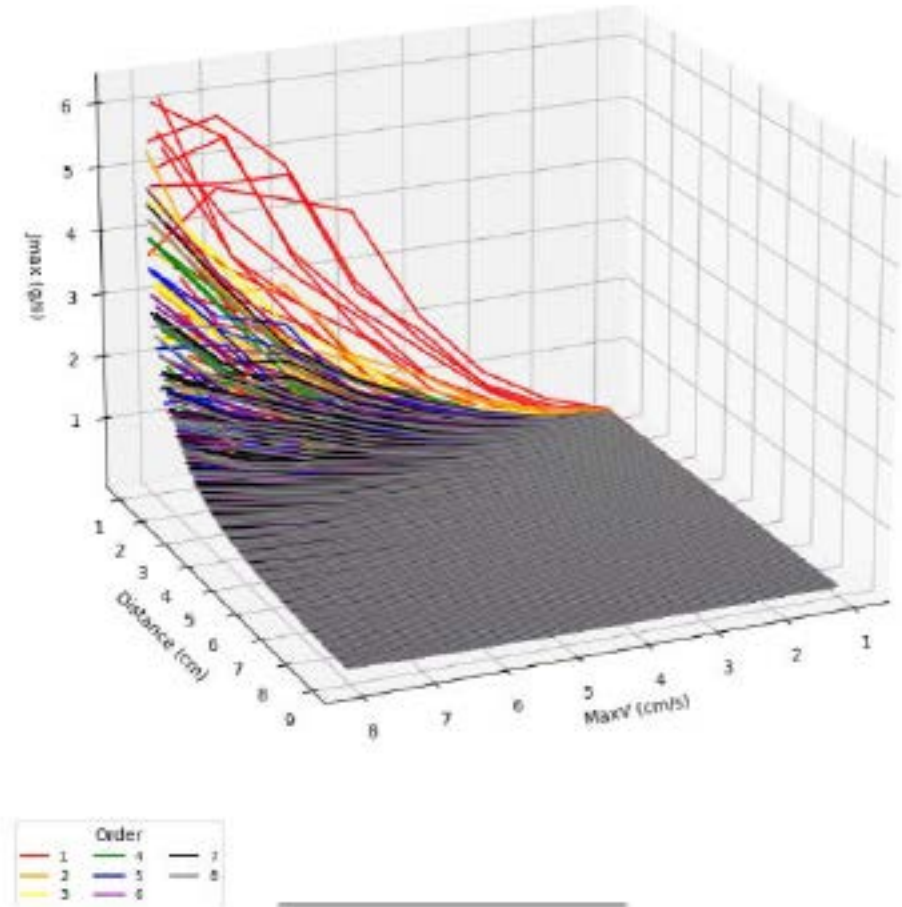
.
We observe a similar erratic behavior in our 4-dimensional plot with Jmax as our output. In Figure 10, low distances and high maximum velocity give a similar high peak jerk but steadily decreases as the constraints loosen up. It may seem like the S-curve profile has little effect on performance after 4cm. But the following slide shows that this is not the case.
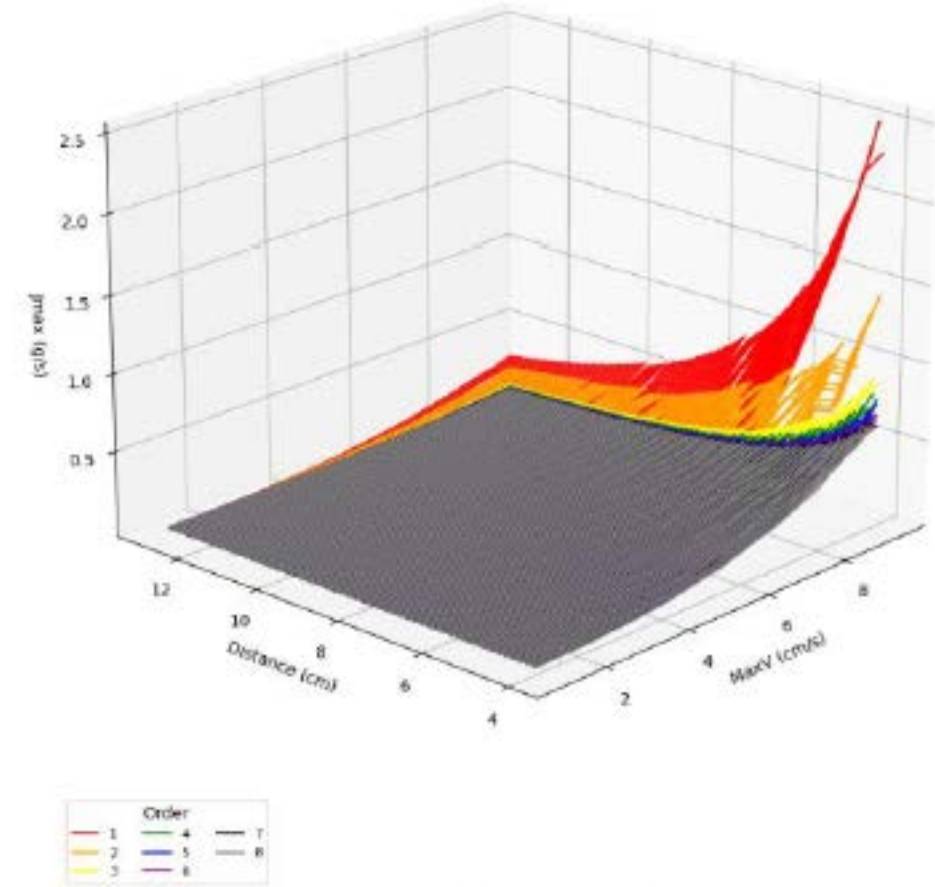

Fig 11: Close up of flattened 4D plot area

Upon closer inspection of the flattened area as velocity and distance increase, we can observe clear decreases and differences in peak jerk values as order increases. There seem to be marginal benefits as order increases to 4, but there is clear space between orders 1 through 3 in the given perspective. Verifying that each jump from the first few orders give a clear and separable performance increase from the one before.

One Dimensional Experiments

The initial experiment case was to test and implement a stepper and DC motor on a one-dimensional rail to compare the data logs for each one. The application of each of these motors are fundamentally different, where stepper motors are a brushless form of direct current motors and DC motors are typically brushed. The algorithm presented is applicable to all motorized devices given the appropriate data for signal input translation such as PWM or duty cycle. Therefore, the goal is to test a wide variety of motors and different applications of them to record any variance in the code and improvements that can be made to improve its reconfigurable nature. The base principle of each experiment will be that the algorithm generates a velocity array that is then converted by a driver function to send the appropriate form of the signal to the physical motor driver which controls the motor.

For the first stepper motor experiment, the part list consists of a Nema 23 stepper motor, DM542 micro step driver, the three-dimensional grid we have assembled shown in the figure 12 and the wiring in between. Our future experiments will build up from this assembly as to retain the integrity of any data gathered to prevent physical hardware from affecting results in different ways as well as being able to work up the dimensions as we move along in the testing process. 3D printed joints and containers were designed to fit each motor and assembly connection to ensure that the frame was secure.
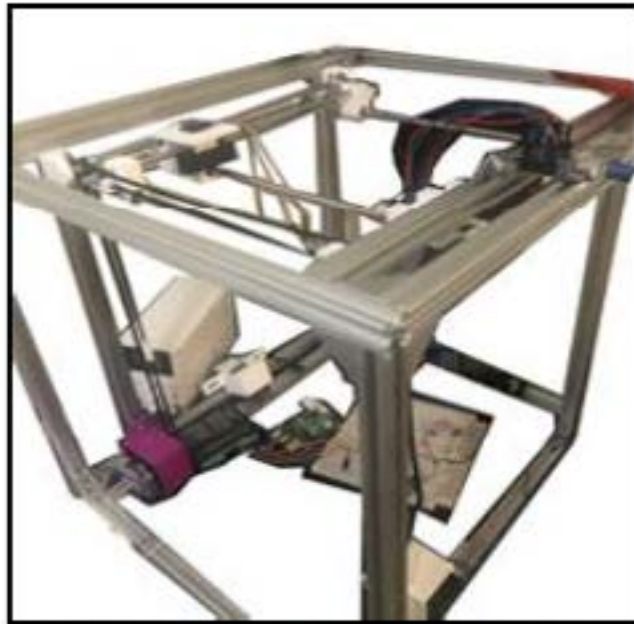
Fig 12: Custom Three dimensional grid for experiments

The pulleys and low friction bars are controlled by one motor for each dimension. A bar is turned by each end evenly to prevent drag. Stepper motor data acquisition is performed by an external Arduino UNO wired to a HC-SR04 ultrasonic distance sensor that is firmly secured in the payload movement's path to lower the impact of sensor vibration retrieve data.

The algorithm was tested for a wide range of inputs to fit the grid's dimensions of 25 cm and various times and orders to ensure that all cases succeeded. Figure 13 shows the distance sensor data readings from the algorithm's two function calls for a 6 cm distance traversal towards and then away from our sensor, 12 seconds total time, and 1 second of delay between the calls. The form resembles the generated plot movement but with heavy noise issues. The issue after debugging was that even at idle, our sensor bounces it's readings more than an acceptable amount which means its quality is not the best for the accuracy resolution that our algorithm is trying to reach. Even expanding the area at which the distance sensor was attempting to pinpoint wasn't enough to smoothen out the readings. We made attempts to add an exponential weighted moving average filter that smooth the data readings but caused a slow response that failed to reach the time constraint. We decided that moving forward, an open-loop motor without encoder feedback is not ideal, given an internal encoder count would greatly improve. This improved data acquisition would allow for reasonable use of a PID velocity based feedback system that would ensure more accurate movements to the target point and improve stability issues from external disturbance.
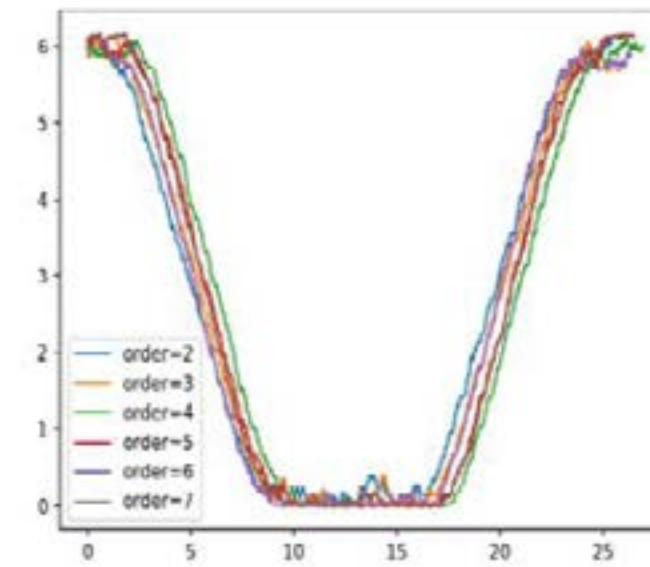

Fig 13: Open loop Stepper motor data

We supported a closed-loop implementation moving forward. Specific test cases would have orders randomly fail, as shown below in figure 14, even if there were no visual errors from displaying the computer-generated S-curve plot. These failures do not happen often but occur enough for us to consider another approach to the open loop design until the bug is narrowed down
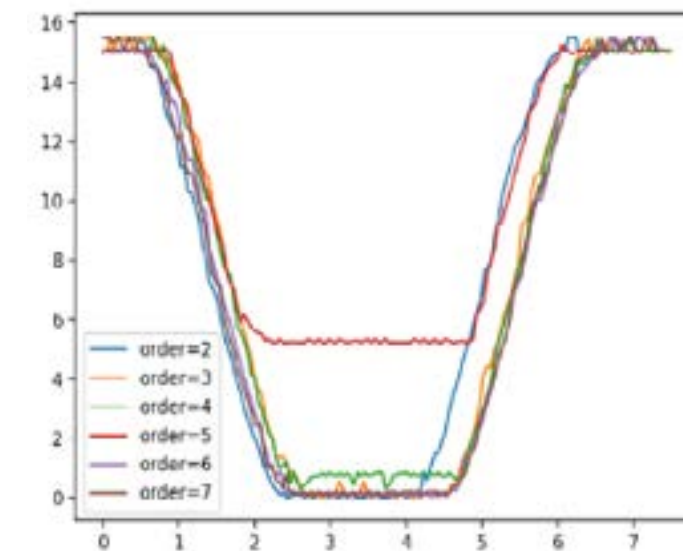

Fig 14: Recorded issues for Stepper motor data

Given these issues and findings, we divided the direction into the closed-loop DC motor experiment to compare the results with the open-loop iteration and see if code portability is feasible. This system improves our process from the previous experiment. Now we have a real-time operating system of an Arduino receiving the velocity signal and converting

internally to use with the PID system inside. The Arduino would be configured to interrupt pins to increase the count every time the encoder sends a signal. The DC motor selected is a medium power 20.4:1 gearbox motor with a 48 (CPR) encoder. We are resulting in a 979.62 counts per revolution after a quick calculation.

The PID tuning process was performed by following the Ziegler Nichols method rules as closely as possible. This process is done by finding the K ultimate/critical constant point after testing for non-damping oscillation after a step input response by the system. Once that period oscillation is recorded, quick calculations of constants are done with the constants below based on the type of controller. This design choice that was selected is a PI controller for ease of design complexity and marginal performance loss from a PID system for a DC motor

Type of Controller	K_p	T_i	T_d
P	$0.5K_{cr}$	∞	0
PI	$0.45K_{cr}$	$\frac{1}{1.2}P_{cr}$	0
PID	$0.6K_{cr}$	$0.5P_{cr}$	$0.125P_{cr}$

Fig 15: Ziegler Nichols Tuning table

Figure 16 below shows some example responses from large and small jumps of step input. Our feedback loop does not have to be perfect for our implementation because the speed increments will be tiny. However, we only see a slight overshoot from the system at a large drop from the image. The color-coding is as follows:

Blue = Desired RPM   Red = Current RPM
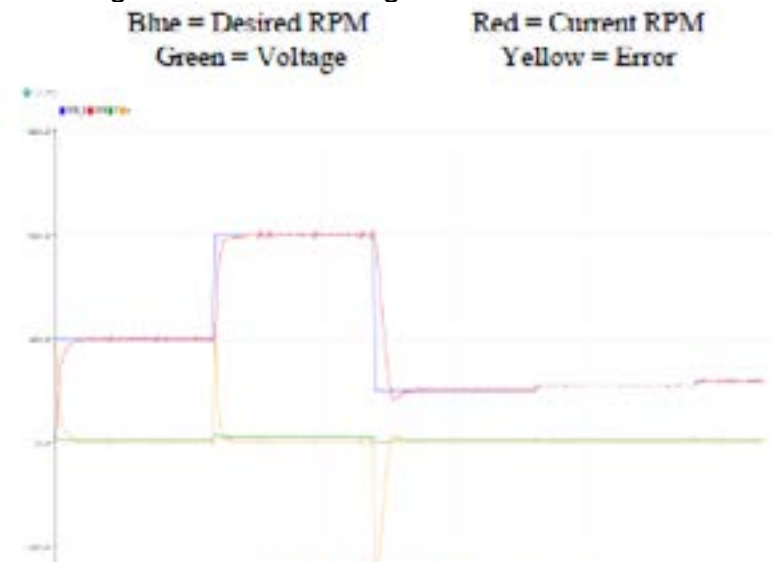Green = Voltage   Yellow = Error
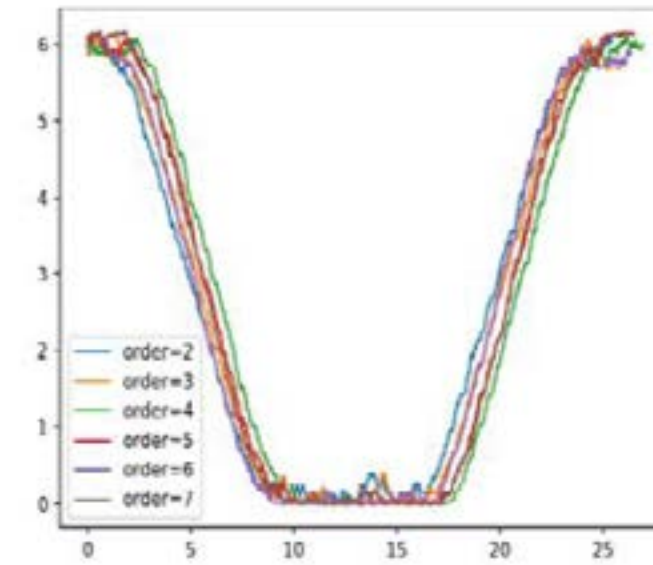

Fig 16: DC Motor PID Response

Fig 13: Open loop Stepper motor data

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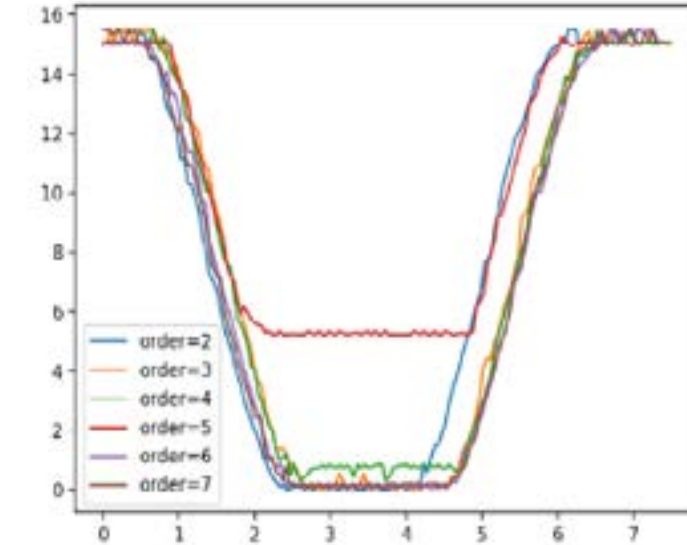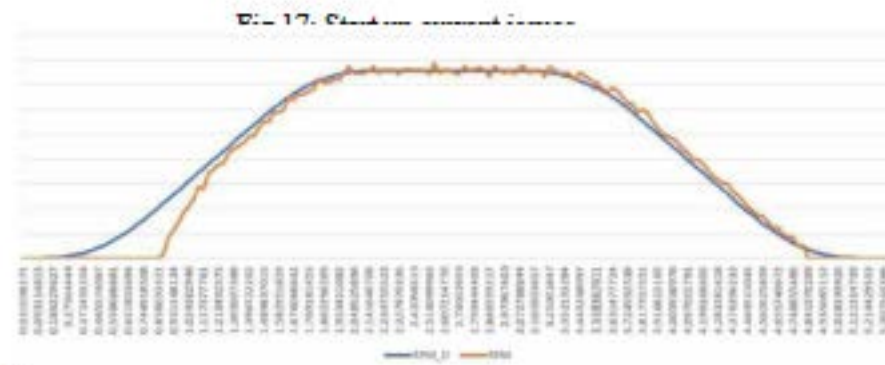

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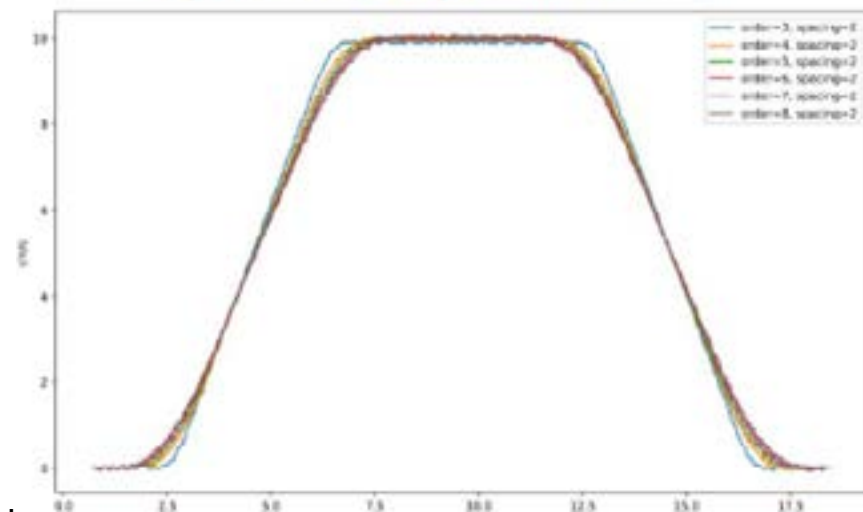
Fig. 17. Start-up current issues

data

After tuning the PI system parameters for our specific motor, our data shown in figure 17 presents a problem with surpassing the start-up current of the engine and being able to reach the low RPM values like the stepper motor. Another fundamental difference between the cases we are trying to port for both. Even adding phase reducing capacitors and re-tuning the PI system would not allow the motor to reach low RPM.

Our solution to this was to propose a 'running start' solution to supplement an offset RPM to have the motor spinning at a constant rate. The solution is valid because, with drone applications in mind, drone systems often prime their motors before taking off, which is essentially our solution. Once we gather the data, we can remove the offset and observe the increase in translated distance as if it was the same as the stepper motor data. In addition to that issue, the Arduino analog pin's resolution is only 8 bits; therefore, we upgraded to an Arduino Due module for its 12-bit resolution and increased timer and PWM count.

Fig 19. DC Motor S-curve profile data orders 1-

After gathering data from orders, 1-8 for input settings of distance traveled and max velocity as 100cm and 10 cm, respectively. The results showed a much stronger resemblance to our software-generated plot. Both issues previously encountered were resolved, and the data acquisition resolution is far higher than the previous stepper motor experiment. The error analysis shown in figure 20 demonstrates that any point error in our displacement is no greater than -0.04 cm. Each ordered plot reaches our input destination accurately and precisely. Meaning we can proceed to more expansive projects like RC and Drone applications while working on the closed-loop stepper motor case to compare both closed-loop control applications.
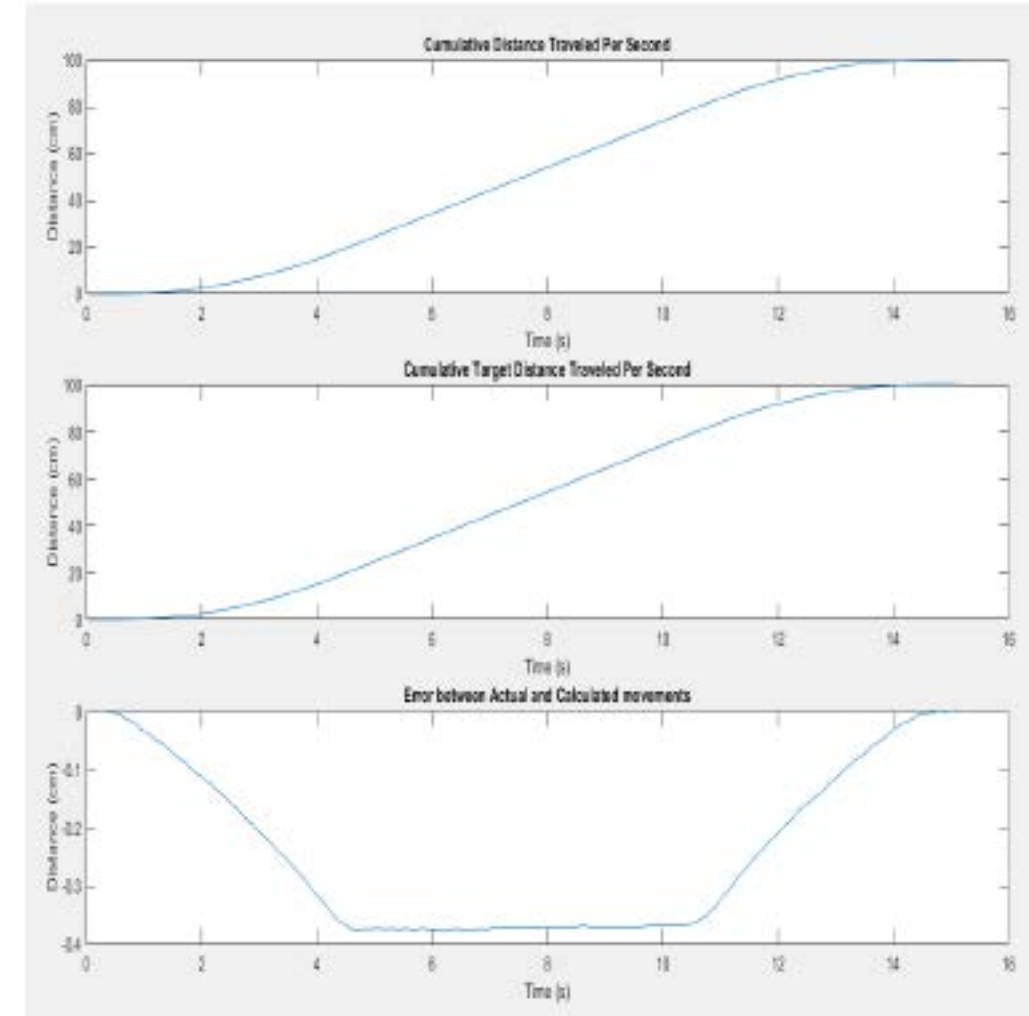

Fig 20: Error Analysis

Drone Experiment & Progress

We proceeded to build our drone, given that there are many online resources to follow with detailed instructions of what is needed for hardware and software. I was able to source the parts, organize, and help put together the drone needed to test our motion profiles. The flight controllers chosen were the Pixhawk 2.4.8 and NAVIO2, as they were by far the most popular non-racing drone controllers on the market. The main issue foreseen is fewer tutorials show controlling a drone remotely with code rather than the transmitter.

Building was complicated given the COVID pandemic. Most of the time allocated for it was spent soldering the connections and ensuring no shorts or exposed metal that will destroy our expensive controllers. However, we were able to build drones with each controller as shown in figures 24 and 25. Other than that, many configuration and calibration steps need to be taken before flying can be considered. The leading platforms for these calibrations are Mission Planner and QGroundControl.

The idea was to use DroneKit's API to change the groundspeed velocity in timed intervals towards a fixed GPS location hardcoded inside the program and test a simple straight-line movement. Once that would be verified to use another generation of our code to test two-dimensional movements and accuracy to the same point. This process is still in development since there is an issue with either the motors or speed controllers on the Pixhawk drone where there is an uneven amount of thrust being applied from the motors— causing the drone to flip over and crash. The presented algorithm injected into the DroneKit compiles and runs, so the problem is strictly hardware-based as of the moment. Currently the NAVIO2 drone does not have this thrust issue and therefore we are going to shift focus to it and push for that to be the first drone to have its maiden S-curve motion profile flight. One of the benefits of having two drone projects simultaneously is that we can compare the current status of each while we work in parallel to determine if problems are hardwarebased

Fig 24: Pixhawk Custom Drone

Fig 25: Navio Custom Drone

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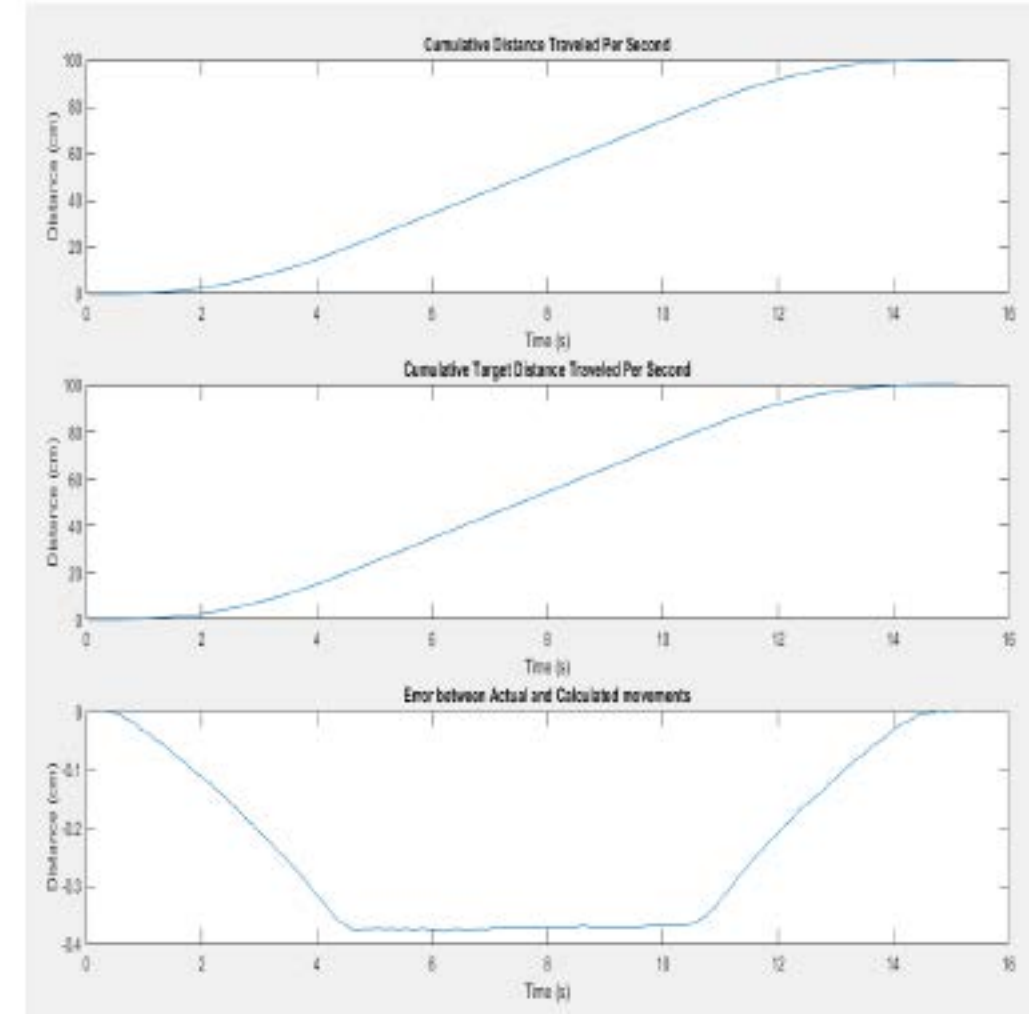

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We proceeded to build our drone, given that there are many online resources to follow with detailed instructions of what is needed for hardware and software. I was able to source the parts, organize, and help put together the drone needed to test our motion profiles. The flight controllers chosen were the Pixhawk 2.4.8 and NAVIO2, as they were by far the most popular non-racing drone controllers on the market. The main issue foreseen is fewer tutorials show controlling a drone remotely with code rather than the transmitter.

Drone work in progress that needs to be put into consideration is drone airspeed vs. ground speed. The drone could be moving accurately in its system, but disturbances such as heavy wind would drastically hurt performance if no accommodations were made. Ideally, in the future, work will be done to add another layer of PID feedback to the drone to compensate for aerial disturbances and keep to the S-curve profile as much as the flight path can. If it is unable to, there should be an implemented protocol to take over whose main priority is to keep the payload and craft stable and safe before resuming on the path.
Discussion

In conclusion, the presented algorithm has shown that the reconfigurable S-curve motion profile algorithm generates profiles according to user inputs such as distance, time, max velocity, and order. Presented the argument of how traditional motion controller devices fail to reach a wide variety of consumers. Whereas our implementation is a practical software application to add a layer of stability to any motorized device by replicating the S-curve profiles in the real-world applications. This paper presented detailed analysis of how the algorithm generates each profile and a variety of test implementations that have shown promising data or are in development in functioning with S-curve motion profiles. The end goal of this project is to have as many working implementations of real-world applications as possible. The current target being drone flight and the RC rover car that will be the trademark of our accomplishments.

Moreover, we develop a new physical docking mechanism for small flying elements as drones to exchange data at a high-rate and fueling batteries on-fly. Such a future system will benefit from the stability the proposed motion controller is providing the flying elements. We also develop a feedback control mechanism taking the airspeed as feedback to individual motors on drones for such a future system.

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Soria   **The United States and China: On the Cusp of Conflict**
Jeffrey
Abstract

In recent time, China has experienced a prominent rise in their global power as a result of their growing economy, technological advancement, and expansion of military capabilities. While their rise to power has been generally peaceful, recent power developments by China have sparked the attention of the United States. Such developments include China's territorial expansion into the South China Sea, and their increased political involvement with the territorial ownership of Taiwan. As the United States has reigned supreme as an international leader and figure, their national interest is to retain their position in the global community. As a result of China's increasing opportunity to surpass the U.S. in international prominence, the U.S. has become cautious about their position and relationship with China, as the probability of their authority being challenged increases. In an attempt to contain China's expansion and limit the scope of their power, the United States has developed an ever-evolving strategy for proceeding with their relationship with China. Experts in the field have also taken note of the severity of the situation, devising the future of their relationship and any possible repercussions for all observable outcomes. In a best-case scenario, both China and the United States will cooperate in their relationship. A worst-case scenario, greater, long-term conflict between these countries will arise and create devestating effects to the rest of the international community. These rivaling perspectives have been examined to understand and provide meaningful application of international relation theory. While there are different camps of theoretical deduction, realism provides the greatest opportunity to examine both potential outcomes of the U.S./China relationship. The most prominent perspectives of realists have been attributed to a balance of power and power transition theories. This thesis seeks to examine these rivaling theoretical perspectives as an application towards the U.S./China relationship and strategies. With hope, this theoretical framework seeks to provide further insight that can help provide deduction and prediction of their future relations.

Introduction
a. Introduction of Power Relations between the U.S. and China

With the largest population on Earth, China has steadily been advancing their presence in the international community and is recognized as a rising power. This has largely concerned the philosophical and strategic interests of the United States, which has been universally recognized as a leader in the global hegemony. The United States has been able to reach this level of international recognition due to the political circumstances of the twentieth century. Since reaching the top, the U.S. has been active with their partnering countries and closely examining the relationships they retain. As such, the United States began to take notice of China's rise in power as they started to modernize their country towards the later half of the twentieth century. China has harvested their increased global presence through the expansions of their technological advancements, militarial capabilities and economic prosperity. As China continues to escalate in power, their ability to influence global realities becomes more prevalent. This power acts to decrease the amount of influence that other powerful nations, such as the U.S. currently possess. With the potential shuffle of the global hegemony, the United States has begun to adjust their international

strategy of containing China's rise to power. "Issues surrounding power transitions--the relationship between a rising state and a declining great power (often the hegemon)--are an important topic for both international relations theory and contemporary policy" (Zhang, 2020). This process is not new for the U.S., as they have substantial history in preserving their own identity and influence in global politics. However, as the U.S. has begun to initiate their strategic containment plans and policies, China has started to take notice, and the repercussions of these actions are creating unavoidable tension. The influx of rising power and escalating tension between China and the United States has created a questionable state of the global community. As a result, scholars and political leaders are investigating the potential for future conflict between these nations, or the possibility of continued peace. The largest question between the U.S. and China remains through the uncertainty of their situation and of each other. "The conventional wisdom in IR holds that when the declining state is uncertain about the riser's intentions, power shifts can produce preventive war even between rational rising and declining states with compatible goals, due to rational-but-misplaced fear" (Yoder, 2019).

b. Statement of the Problem

As the biggest topic in international relations, the future of U.S./China relations remain a prevalent conversation in modern academia. Most scholars have argued in their research that with the current strategic evaluations of their affairs, China and the U.S. are headed to become adversaries in the future. This potential conflict has risen as a result of China's rise in power and the United States' demise in their global hegemony. As it stands, conflict is the connection and relationship between the methods of China's continuous rise and how the U.S. shifts and adapts their strategic policies. "The rise of China can be perceived either as a threat or as an opportunity to and for the US, mostly depending on US grand foreign policy interests and its related strategies" (Pratiwi, pp. 351). If a threat is imminent, a future conflict between China and the United States could devastate not only the international community, but their own domestic fronts as well. Great powers, such as these nations, are interwoven members of the global community, allying with many smaller nation states. With both China and the U.S. also leading the world's economic system, those allying states are dependent upon the support and market opportunities with them. Long-term conflict between these nations would surely produce a negative domino effect towards their allies. Additionally, both the U.S. and Chinese economies would also collapse. The costs of potential war between China and the U.S. are considerably high, for themselves and for the global economy. Predicting the outcome or probability of conflict/peace between China and the U.S. remains a difficult challenge. Scholars of international relations have sought to assess their theoretical applications through the perspective lens of realism, liberalism, and constructivism. Even within each camp of ideology, there exists multiple theories that attempt to conclude different possible implications. With multiple perspectives, it becomes difficult to rationalize and infer the state of relations between China and the U.S. This study will, instead, investigate the realist camp of theoretical inference to provide context and analysis to the future relations of these nations.

c. Introduction to Theoretical Framework

The theoretical framework of this thesis takes a deeper investigation into established and prominent theories of realism that help to explain the different implications/outcomes of international relationships. Examining international relations theories is a prominent source for theoretical analysis due to its influence over strategy and politics. Before offering a substantive summary of the theories that will provide the foundational support for this thesis, it is important to introduce the school of thought that they reside in, realism. Realism was developed within the context and creation of other international relations camps and ideologies. Realism remains as one of the dominant schools of ideology in international relations, and can be traced back to scholars such as Thucydides in Ancient Greece. IR theory was created out of the age-old contemplations of war and the causes of it. In its most simplistic form, realists seek to answer the conflictual arrangements that are created out of international relations. From the realist theoretical framework, scholars have since devised calculated observations of perspective in creating the theories of interest for this thesis: power transition and balance of power. These theories have been the most prominent in realist schools of thought and have largely shaped the outcome of U.S. strategy and policy. "US policy has been shaped by two distinct schools sharing the balance-of-power concept within the realist paradigm" (Wantanabe, pp. 6).

Power transition theory contends that conflict arises between great powers when the rising force is dissatisfied with the status quo and wants to change the system. The most prevalent scholarship pertaining to this theory rationalizes that China is dissatisfied with U.S. involvement in the territorial disputes of Taiwan, and that disatisication will ultimately create conflict between them. However, there is a possibility that conflict will not arise as a power transition between these nations. Balance of power theory investigates that employing balancing techniques and strategies to rising powers will avoid conflict. Scholarship within this framework finds that the U.S. deploying military personnel and strategies in the Asia-Pacific region will allow them to avoid conflict as they are working to balance China's influence in the region. Just as power transition theory studies highlight that conflict can be created through this theoretical perspective if the incumbent power fails to provide substantial balancing strategies to the rising power. Through the foundational support of realist thought, these theories will offer different perspectives and implications within the same camp of ideology to provide the essential tools for analysis to properly examine the future relationship of China and the U.S.

d. Statement of Purpose

This thesis will examine the nature and relationship between realist theories, ideologies, and strategies in analyzing the state of China's rising power and the American response to it. The existing scholarship and pre-determination of China/U.S. relations deduces that conflict is gaining momentum. However, due to the theoretical nature of this examination, it is impossible and academically irresponsible to provide a definitive answer to the outlook of the U.S./China relations. Therefore, for the purpose of this study, different perspectives of international relations ideology will be thoughtfully analyzed to engage with the subject matter. Examining different perspectives, from their similarities to their differences, it will be possible to illuminate the full spectrum of possibilities when investigating what the future relationship between China and the U.S. might look like. This study will only be concerned with the main theories of realism in international relations.

Power transition and balance of power theories provide enough substantial and rivaling viewpoints of the U.S./China relations that can give enough meaningful analysis to further understand their potential outcomes.

Firstly, this thesis will undertake A.F.K. Organski's original deductions of power transition from his work, World Politics, that will provide context for providing the first major source of perspective. The second perspective will be provided by William Wohlforth, who provided the foundations for consistency in defining balance of power theory in his article Testing Balance-of-Power Theory in World History. After the proper application of theory has contextualized the U.S./China relationship, this thesis will then bridge theory with these nations strategies. The perspective of both authors will be backed by additional scholars and experts to provide substantial evidence supporting their work. Strategies and implementations that will be examined include the events ongoing in the Asia-Pacific Region and the territorial disputes of Taiwan. The examination of real events and interactions between the U.S. and China will provide enough evidence of their strategies and potential for peaceful/conflictual outcomes. Overall, this thesis will map the perspective and position of realism theory that is grounded in the relations of the United States and China. The case of this thesis will ultimately examine the relationship between realism theory and U.S./China relations within the context of the later nation's rise to power. This thesis examines the question of whether the evolving strategies between the United States and China are leading to inevitable conflict or cooperative peace. Analyzing the main question of this thesis through different ideological perceptions will result in the creation of further sub-questions and perspectives.

-Why are power transition and balance-of-power theory an applicative approach to studying U.S./China relations and what do they have to say about their potential for peace/conflict?
-Is power transition or balance-of-power theory a more appropriate realist interpretation in studying the dynamics of the U.S./China relationship?

e. Significance of the Study

With China's continuing rise to power, the subject and debate between China and the U.S. remains one of the most prevalent subjects today. Lack of a general grand strategy towards China results in the ongoing discussion and evaluation of future policy implementation and tactics. Continued discussion and need for a definitive strategy creates the desire for evaluative recommendations. Furthermore, there have been multiple attempts by academic scholars to provide the context, evaluation and perspective of international relations theories towards the implications of the future relationship between China and the United States. This thesis wishes to continue the work of previous scholarship that has provided the relevant and necessary groundwork by bridging theory and application of strategy. It seeks to provide to the scholarship a consistent and coherent work of observation that can be useful in further developments between the United States and China. This work will become even more critical to academia as tensions continue to escalate between these nations. As long as there is the possibility or likelihood of conflict between China and the U.S., this work can provide substantial investigation and context for analysis.

Literature Review

This literature review first discusses two topics that will help provide and shape part of the context for the analysis: China's rising power and the examination of the U.S./China strategies against each other. This is relevant to provide the necessary background and history to provide an established foundation for understanding the dynamics between these nations. Once this is complete, the second half of this review will engage in the ideology of realism, followed by its two most prominent theories: power transition and balance of power. Highlighted in this review are the works of A.F.K. Organski and William Wohlforth. Ultimately, the establishment of historical context with the applicative utilization of theory will provide the tools and guide for developing the later portions of this paper.

a. China's Rising Power

Before we can examine the current state and evolving strategies between China and the United States, it is important to establish the scholarship that accepts China's growing power. The rising state of China has become one of the most prevalent topics in international relations. China's growth has been exponentially increasing over the past few decades in part to their expanding global economy. China began to grow their power towards the end of the seventies, as they started to reform their own economic structure. Since that change, Joseph Tse-Hei Lee found that China's market economy has exploded in growth, producing double digit increases in their gross domestic product (2007). As a result of an expanding economy, the increasing size of their market capabilities has led to more influence and persuasiveness in the international community. At the beginning of China's economic transformation, their economy only accounted for only one percent of the world's economy. Zheng Bijian asserts that, "Today, it accounts for four percent of the world economy and has foreign trade worth $851 billion -- the third-largest national total in the world" (pp. 3). China's rise in economic capability continues to expand faster than any other nation, including the U.S. Robert Ross (2018) argues that the current state of China's economy has influenced other nation's economies dependent on China. However, despite the alarming rise of China's economy, there remains an agreement in scholarship that attests to China's economic expansion as not the sole reason for their rise in power.

From China's expanding economic capability, those increased profits from their markets allowed for further military developments. Recent efforts by the Chinese military has focused its priorities to modernizing their forces. Thi Thuy Hang (2017) assessed that China's military building efforts have been focused towards emphasizing maritime securities, long distance mobility operations and cyber attacks. Scholars generally argue that along with the expansion of their military, their navy operations too have grown in quantity and quality. Understanding China's rise, from expansion in their economy to advancements in their military foundations, is critical to understanding how relations are being transformed with the United States. China's rise in power is the foundational phenomenon that provides the basis and grounds for this thesis. Scholarship regarding U.S./China relations and strategies investigate the changing dynamics challenged by China's rise to international leadership. However, the unknown implications about China's rise in power is creating the necessity for further investigation and study. Scholars are unsure how the continuance of fluctuating power relations will influence other nations in the community. The literature

finds that while other great power nations are beginning to prepare for future conflict, there is little understanding about what points will tip the balance with China's partners.

b. U.S. and China Strategies against Each Other

China's rise in power has resulted in both countries devising strategic tactics and policies toward each other. As a rising power, China has no choice but to continue their expanding path towards hegemonic leadership, caring little for who might stand in the way. As the current dominant power in the international arena, the U.S. has no choice but to defend their position in the global order to protect their own national interests. Wexing Hu (2020) argued that the U.S. views China as a direct challenge to their own influence and interests, which ultimately threatens their future prosperity and security as a nation. Part of the U.S. strategy against China can be outlined there, a plan called the Indo-Pacific Strategy. This is to limit the scope of mainly China, as well as other rising nations near the Indian and Pacific Oceans. Currently, China has no official response to this specific strategy, and scholars debate what impact this will have for the international community. Scholarship argues that an unofficial response to this strategy has China mitigating any security risks while continuing to expand their own influence in specific regions. Such strategies can be prescribed by certain literature to be 'a negative balance.' Negative balancing strategies refer to a nation's effort to undermine their rival's power. Kai He (2012) argued that China has deployed negative balancing strategies in its efforts to undermine the U.S. hegemony. As a result of China's self-perspective as a rising power suggests that their opinion is that the U.S. is not an immediate threat to them. Furthermore, scholarship has analyzed that economic policies have become a critical component for China's strategies against the U.S. Aaron Friedberg (2017) examined that China has pursued an economic strategy that has promoted their own development at the expense of their partners. Such advancements could be used to surpass the U.S. in total gross domestic product.

There remains an agreement in the literature that validates the need for U.S. strategy development against China. The rising tension between these nations, and China's recent investments into nuclear technologies, addresses the need to protect national security. Charles Glaser (2016) argues that the U.S. is actively assessing whether to expand or minimize their damage-limitation capabilities in the case of a potential nuclear war with China. Other scholars adhere that these assessments are congruent with China's expanding military power. With China possessing further military capabilities for deployable strategy against the U.S., America is further increasing their own military presence in the South China Sea. Derek Grossman (2019) assesses that the Taiwan disputes and involvement in the Asia-Pacific region are key components to U.S. military strategy against China. However, the literature cross-examines how effective these strategies and tactics will hold against their developments with China.

Assessing the literature regarding China and the United States' strategies towards each other portrays a cause-and-effect relationship. When one nation deploys certain tactics, the other retaliates in anticipated strategy. The main causes for strategy development between China and the U.S. involve China's economy and military expansion, investments in nuclear technologies, involvement in the Asia-Pacific region and territorial disputes over Taiwan.

c. Realism

Realism has a substantial history of theoretical deduction and evaluation, primarily through the realization of international relations. It has been established through careful consideration by intellectuals and scholars such as Thucydides and Machiavelli. As time has progressed, the concepts and definitions foundations of realist thought have evolved further into the modern era. With the ever-evolving times, scholars suggest new principles and substitutions to redefine the ideologies of realism itself. For example, William Wohlforth (2011) found that applying the substantial work of Kenneth Waltz was critical in developing the modern-day classifications of realism. As such, realism began to formulate new and invigorating theories within international relations, and began to subcategorize itself into separate camps, such as classical and neo-realism. Its importance to theory and political institutions remains in its ability to help formulate debates and intuitions about the world and how to understand it. There is a general consensus in the scholarship that realism has substantial principles and ideology to offer the world. Duncan Bell (2017) argued that realists offer answers to methodological, ethical, and political questions. Its ability to shed insight and perspective of the shaping political world has a lot of powerful ability to relay the interests and identities of the international system. Ultimately, realism is a political conception that concerns itself with attempting to convey arguments toward the politics of the world. Inanna Hamati-Ataya posed that, "Among the many reflexive questions scholars may ask, the ultimate interrogation that concerns IR is the following: how is theory itself affected by the cultural, normative, and material characteristics of the international system, and the position of IR theorists within it?" (pp. 1081).

d. Power Transition Theory

Power transition theory is a realist ideology that analyzes the structure of international politics. It portrays international relations as fundamentally rooted within a hierarchy of nations. The dominant power of the hierarchy possesses the highest proportion of resources at their disposal. Power transition theory contends that war between nations arises when the competing state rivals the power of the incumbent leader, and that they are dissatisfied with the current system. Power transition theory is generally presented to prescribe a forthcoming power between two great powers. Many scholars argue that the future of U.S./China relations look grim as a result of the application of this theory. Yves-Heng Lim (2015) argues that China has become dissatisfied with the current system as a direct result of U.S. involvement in the Asia-Pacific Region. Lim further contends that U.S. withdrawal from the region or acknowledgement of China's claims to the area would satisfy China, and that war would be inevitable. Other academic research has found that while this power transition will still result in war, it is not derivative of China's disasstirication, rather, it is that of the U.S. Serafettin Yilmaz (2019) assessed that China is content as a rising power, and that the United States' dissatisfaction with the status quo could lead to war, despite their position as the incumbent hegemon.

Additional scholarship investigating power transition theory also examines that there is a lack of existence in power transition. Renee Jeffery (2009) analyzed that China resumes a non-threatening position to the U.S., and as a result, a power transition between the U.S. is not likely. However, Jeffery argues that there is still the possibility of conflict over the

ideological clash of Taiwan. Further scholarship assesses that power transition theory will not hold true between China and the U.S. due to each nation's military capabilities. Woosang Kim (2015) found that power transition theory argues that if China's military cannot overpower the U.S., then the likelihood of conflict between these nations diminishes. This ideology is further supplemented by the rationale that conflict will not arise further even if their military powers are equally matched, and if China remains satisfied in the status quo.

While power transition theory has risen to prominence in international relations theory, the originating source of its creation, A.F.K. Organski, still sets the standard in the academic community, as outlined in his work World Politics. Organski asserts that power transition is the prominent theory in scholarship due to the nature of power being unable to balance itself in the international community. Organski outlines that there are three stages to reaching a full power transition: stages of potential power, transitional growth, and power maturity. The final level is obtained when a nation becomes unanimously industrial and their economy continues to expand. When a nation reaches capacity for full power transition, there are two realities that set the stage for potential conflict between the existing hegemon and rising power. Organski contends that powers, who are satisfied in their position, who maintain dominance over the international system usually arrive at peaceful cooperation. However, war may arise when, "A recently industrialized nation may be dissatisfied with the existing international order because it rose too late to receive a proportionate share of the benefits, and it may succeed in drawing to its side lesser nations who are also dissatisfied because they are exploited by the nations that dominate the existing order" (Organski, pp. 372). Overall, wars between nations in power transitions will start as a result of the challenging nation's power equalling the dominant nation, if their rise is rapid, and they have reached substantial levels of dissatisfaction.

A majority of scholars find that the application of power transition theory will ultimately lead to conflict between China and the U.S. This theoretical application is a result of scholars investigating that China has become dissatisfied with the original status quo, and seeks to challenge the U.S. for hegemonic dominance. Their disastrication has largely grown from U.S. involvement in the Asia-Pacific region. Other scholars argue that power transition is not likely, as China is not an imposing threat to the U.S. Furthermore, if China cannot surpass U.S. military capabilities, then a power transition is not possible according to the theoretical framework. Common pitfalls in power transition research finds difficulty in measuring the determinant leveling of what makes a country truly dissatisfied. Satisfaction and dissatisfaction remain determinant variables that are left to interpretation by the scholar.

e. Balance of Power Theory

Scholars have created a balance of power theory as a realist interpretation to international relations in analyzing the strategies of war creation or prevention. Balance of power theory rivals power transition theory in that while the latter dictates war is inevitable, the act of balancing great power relationships can/will avoid conflict. This theory is one of the most fundamental cases within international relations. Balance of power theory retains the idea that a nation protects its own survivability by limiting the power of other rising states to prevent them from dominating the international community. When a certain state begins to feel threatened by another, they might employ balancing tactics against the rising power

as a defensive mechanism. A nation's attempt to balance a rising power is utilized to prevent conflict between themselves and their rivals. The perspective that has established and connected the U.S./China relations prescribes that the U.S. has been strategizing as a balance towards China's rise over recent time. Wooseon Choi (2007) acknowledged and analyzed that China was the first to apply a balance of power strategy toward the U.S. with their alliance to the Soviet Union during the Cold War. This was a result of America's emergence in power towards the end of that conflict with Russia. However, this time also marked China's rise in prominent power, and as time passed, the U.S. shifted their own policies and strategies to balance China. Robert Ross (2006) further argues that balance of power theory plays an intrinsic role in examining the dynamic relationship between China and the U.S. This camp of ideology argues that balancing of power behavior plays a pivotal role in great power relationships. Ross further exemplifies that both China and the U.S. are currently employing balancing tactics and strategies in their interactions in East Asia. Proof that balance of power strategies are being deployed in this region is highlighted by the use of military and strategic cooperation by both nations.

It is also important to note that some scholars evaluate the deployment of balancing strategies to also lead to inevitable conflict. Shih-yueh Yang (2013) proposed that during the process of nations' balancing strategies and policy enactment, the likelihood for war to arise becomes greater until the balance of power is restored between nations. Other ideological responses to this perspective ascribes to the rationale that many nations have not formed well developed balancing strategies towards China. Zhen Han (2020) argues that if there are not harder balancing strategies deployed, especially in the Asia-Pacific region, conflict will arrive. Despite this analysis, Han also contends the livelihood of China's prosperity will have to include future economic relationships with nations, such as the U.S.

Balance of power theory provides a great source of analysis and examination of the wearing state of affairs between the United States and China. In this perspective of realist ideology, it can be addressed that the competing/rising nation can be balanced by the existing hegemon to create an equilibrium in the international community. However, the issue with this theory is the abundance of different definitions the scholarship creates. William Wohlforth's exceptional article, in his examination of balance of power theory in the world order, provides the appropriate context for analysis of the U.S./China relationship. "This version of balance-of-power theory posits that because units in anarchic systems have an interest in maximizing their long-term odds on survival (security), they will check dangerous concentrations of power (hegemony) by building up their own capabilities (internal balancing), aggregating their capabilities with those of other units in alliances (external balancing), and/or adopting the successful power-generating practices of the prospective hegemon (emulation)" (Wohlforth, 2007). Through this assessment, balance of power theory can help explain the outcomes between rising and existing hegemons.

f. Discussion

It is important to establish the main takeaways from the literature and summarize the main implications from those studies. For power transition theory, scholars have analyzed that it is mostly China who is dissatisfied in their relationship with the United States. As power transition theory states, a nation's dissatisfaction with the status quo is a primary

precursor to the start of a conflict. It is important to highlight that China's dissatisfaction is derivative of U.S. involvement in the Asia-Pacific Region, which is a result of U.S. military strategy against China. Scholars of this perspective also retain the possibility that China and the U.S. will not arrive at conflict as a result of a power transition. For balance of power theory, scholars argue that the U.S. is applying balancing strategies against China to avoid future conflict with them. The strategic and military deployment in the Asia-Pacific region by the U.S. is proof of their attempts at balancing their great power relationship with China. However, scholars establish that conflict can still arise from balancing strategies. Conflict can be created in an imbalanced relationship, and if the U.S. fails to fully balance China's rise in power, conflict will be created until that balance is restored.

Methodology

This section of the thesis will seek to examine the methods of analysis for conducting this research to arrive at a reasoned conclusion.

a. Introduction to the Research Question

This thesis seeks to examine and answer whether the evolving strategies between China and the United States are leading towards conflict or peaceful cooperation. With the theoretical and predictive nature of this thesis, this research will seek the guidance and connection of international relations theories to reach an appropriate conclusion. As a result, two further questions need to be sought and addressed while attempting to arrive at the main conclusion of this paper. These additional questions will examine whether power transition and balance of power theories are applicable approaches to answering the question and what their implications have to say about future China/U.S. relations. Additionally, the examination of which theoretical application is more suitable for analyzing China/U.S. relations will be contemplated.

b. Study Design and Context

The purpose of this research is to examine the main theoretical perspectives that shape the scholarship regarding U.S/China relations and strategy to predict the potential of conflict or peace. In effect, the strategies and geopolitical implications between the United States and China will be examined and approached from the context of theories of international relations. With the theoretical nature of this research, it will be conducted as an evaluative study between the theory and exemplification of cases. The research design will explore a descriptive content analysis of each theory's implications towards U.S. and China strategy in order to predict what the future relationship between these nations might look like. The main focus of the methodology will be the application of theory toward cases of implication that resulted in China and U.S. strategy against each other. The analysis framework of this research will focus on the work of the theoretical authors of William Wohlforth and A.F.K. Organski, who created an updated balance of power and created power transition theories, respectively. It is important to use the work of the original theoretical proprietors, as these established theories have not been changed or tampered with. It will further be examined under the context of the literature established for this research, which has been created with the purpose of correlating those theoretical

perspectives to the realities of the U.S./China relations.

By investigating the theoretical examinations of power transition and balance of power, it is important to establish the guidelines for the analysis that suggests the potential for peace or conflict. For power transition, there are certain expectations that can be found if the United States and China are reaching toward conflict or not. If a power transition is to occur, and conflict does arrive, then we can expect to see China's power and influence continuously expand in various governmental sectors. A power transition can only arrive and create conflict with the rising influx of power of China. This can be visualized in sectors such as rising GDP figures and increasing Chinese investments in their own infrastructure. On a relational level, we should observe that the United States has increased their dealings with Taiwan. If we can observe a failure in the arrival of power transition, we should observe that China's power begins to either decline or remain stagnant. Furthermore, the United States' involvement with Taiwan can either be dissolved or decide to deploy distant levels of operations with them. For balance of power, there are also expectations that can be met if the U.S. and China are heading toward cooperative peace. If cooperative peace endures, then the United States has proved that they have engaged in effective balancing strategies against China. We could observe that the United States is maintaining effective external relationships with allying nations, and possibly even looking to formulate new ones. Additionally, the U.S. would further increase their own internal security strategies and policies. Finally, the United States could either maintain their current posture in the Asia-Pacific region, or possibly resign from the region to pursue peace between them. If balance of power tactics does not arrive, this fact could be the result of their alliances not being strong enough or their pursuits causing too much tension/conflict in the region.

c. Sources + Collection

The main case for data collection in this research is purely qualitative and is sourced by applying theory/goal of hypothesis. As a result, the publications that were analyzed in context with the research were sourced through scholars, experts, and researchers of international relations. The insight from the utilized scholarship in this thesis relates to the concepts of the rise of China, U.S./China relations, realism, power transition theory, and balance of power theory. Different authors and experts' observations and analysis are obtained for prominent background and insight to the development between China's rise in power to their relations with the United States. Additionally, different scholarship regarding international relations and realism is dissected to provide deeper insights into the existing literature and perspective of experts. Sources highlighting power transition and balance of power theories provide the foundation for analyzing two different perspectives of realism to analyze the hypothesis of the thesis. It was equally important to collect these sources that weigh different perspectives and outlooks regarding application of theory/prediction of outcome. While it is generally accepted that the realist perspective in international relations believes that the outcome between the U.S. and China will be stable and peaceful, it is critical to obtain literature that attests that realist ideology can deduct the potential for conflict as well. Finally, the main evaluation of theory is being taken from the works of A.F.K. Organski's World Politics and William Wohlforth's Testing Balance-of-Power Theory in World History. These works will provide the main insight to apply the appropriate theoretical perspectives towards the relationship between China and the U.S.

d. Focus on Realism

The choice to focus this research utilizing two prominent theories of realism is strategic. While other theories of international relations contain useful tools for analysis, their goals and focus are not best suited for the context of this thesis. Other theories that were not included in this research are the ideological camps of liberalism and constructivism. These schools of thought project different sources and tools of analysis for their connections of the U.S./China relationship. Liberalists are mainly concerned with the domestic and economic interdependence factors in their application of their relationship. Constructivists only look for the goals, ideas, and elements that can shape the international order. Realists are only concerned with security and material powers. Even with realism, there are other expansions of ideology in the camps of neo-realism or classical realism. To simplify the analysis of this thesis, only the general assessment of overall realism will be evaluated. Many scholars have already attempted to transcribe the similarities and differences between these schools of thought, such as realism v. liberalism, or realism v. constructivism. Therefore, by looking to assess two theoretical assumptions of realism regarding their relationship, this research looks to build further investigation into one particular subset of ideology. There is great value and knowledge in analyzing liberalism and constructivism, however, realism offers the most strategic utility in investigating the potential for the United States and China to arrive at conflict.

e. Research Analysis

The nature of this research will not provide a coded or quantitative examination of the material. Instead, this thesis will explore the two perspectives, from its application to its evaluative qualities, of power transition and balance of power transition theories. It will be guided by the works of A.F.K. Organski and William Wohlforth to define the respective perspectives of realist ideology towards U.S./China relations. In analysis of the questions asked in this thesis, the first sub-question will be separated into perspectives. This will provide the context to answer the overarching and second sub-question of the thesis in the conclusion.

Perspective One: Power Transition Theory
-Why is power transition theory an applicative approach to studying U.S./China
 relations?

The standards and guidelines set by A.F.K. Organski in his work, World Politics, will provide the descriptive analysis of power transition theory as an applicative approach to understanding the dynamics of U.S./China relations. To understand the power transition perspective, there must be three qualifying attributes of the rising power: the rising power must equal the dominant power, have rapid growth, and have growing dissatisfaction with their situation. Academic scholarship will be provided to satisfy the requirements of these categories in the different aspects of China's rising power and strategies. By assessing that this situation meets the criteria of the power transition perspective, it presents itself as a qualifying outlook to investigate U.S./China relations. This section will conclude at the projected outlook that this prospective prescribes at either arriving at peace or conflict between the U.S. and China.

Perspective Two: Balance of Power Theory
-Why is balance of power theory an applicative approach to studying U.S./China
 relations and what does it have to say about their potential for peace/conflict?

The outline of balance-of-power theory by William Wohlforth will provide the application of theory to investigate the rivaling perspective regarding the outcome of the U.S./China relations. Wohlforth insisted that there are three qualifications to contend that the dominant power is attempting to balance the power of a rising force. These qualifying factors are: the dominant power is attempting to maximize the survivability, work to balance internally and externally with alliances, and adopt hegemonic power capabilities. Scholarship will provide the outlook of U.S. strategies and engagements that satisfy the qualitative and applicative insight to setting the foundational precedencents of this theory. This section will be concluded by asserting the theories implications of the future relationship between the U.S. and China.

f. Assumptions, Limitations and Timeline

Before we can analyze the research, it is important to declare assumptions about U.S./China relations. First, we must assume that the original creators of the theories utilized in this research remain true and are fully applicable. This will imply that the theoretical works of A.F.K. Organski and William Wohlforth are reasonable sources of application towards investigating the U.S./China relationship.

There are a multitude of limitations that provide difficulty in reaching the conclusion of this thesis, but these challenges are inevitable. Firstly, the scope of this research can only be limited to major points of interest in the case of the U.S./China relationship. It can not be expanded to the probabilities or inference of future, specific developments. As such, only cases such as the Asia-Pacific Region and the disputes of Taiwan can be assessed in this thesis. Additionally, while the rise of China has major implications for all international actors, only the United States can be qualified for examination as it pertains to this study. Furthermore, this thesis does not seek to answer any other questions about the current or future developments in their relationship. It does not regard aspects such as right or wrong, or any other factor, to examine this framework. It simply accepts what is to determine what will be. Finally, this thesis does not answer my own personal opinion about the future outcome in the relations, rather, my own deduction of established theories is predicting.

The timeline for this study ranges greatly between the scholarship used for background in this research and the cases utilized for understanding strategy implication. Timelines for the literature and other background information can range from the beginning of China's rise in the late seventies to the present day. Specific cases are analyzed over recent years, and continue to the present day, as they are still continuing to evolve.

Analysis

In the analysis section, the theoretical qualifications of power transition and balance of power theory, created by A.F.K. Organski and William Wohlforth, respectively, will be presented to highlight the two distinct perspectives regarding the outcome of the U.S./China relations.

a. Perspective One: Power Transition Theory

In this perspective, A.F.K. Organski accounts that there are three qualifications to assess if a power transition is inevitable between the rising power and the dominant hegemon: the rising power must obtain power rapidly, they must have enough power to either match or eclipse the dominant power, and they must exhibit some levels of dissatisfaction with the original system or with the dominant power. These qualifications will be exhibited through the analysis of China's expanding economy, U.S. trade war implications, and discuss China's dissatisfaction with U.S. involvement in Taiwan.

i. China's Rapid Growth in Power

To first qualify as a state of power transition, China must first be identified as a force that is growing quickly and rapidly in power. Through recent time, China has been able to massively expand its economic markets that have pushed their power and influence internationally. China's long-term and rapid growth began to develop around 1992 during the collapse of the Soviet Union. The Chinese government instituted, "aggressive economic reforms re-ignited rapid growth catalysed by large scale foreign trade and investment" (Goldstein, pp. 841). Analysts regard that China's economic growth is a large contributor to their overall testament of power capabilities, and their development has not been replicated by any other nation. "Over the period 1978–2000, GDP may have grown at an annual rate of close to 10%, with per capita income multiplying by a factor of about five" (Boltho, pp. 257). This economic increase in China's economy has developed their position as a major player in the international market. As it stands, China has been able to obtain a prominent chunk of the world economy's GDP, an accomplishment that only other great powers have been able to partake in. China's successful and rapid growth in power has been accomplished through their ability to navigate their way through the challenging and new unprecedented circumstances. In the last few decades, China has witnessed, "an annual 1.2% growth of population and an annual 7.4% increase of per-capita income led to a rising demand of private households in every category of consumption, including energy, e.g. for transportation purposes" (Li, pp .1413). China's evolving economic capabilities is continuing to reshape the global markets and help contribute to their rising power.

ii. China's Power Rivaling the United States

Not only has China's power quickly and rapidly expanded over the course of the last two decades, they are extremely close, if they haven't already, to eclipsing the U.S. in total power. The next qualification of the power transition ideology insists that the rising power must be able to match or surpass the hegemon in power to fully take their position as a leader. China's ability to match U.S. power can be examined through the scope of their evolving economy. During the 2000's, China possessed the largest single source of foreign currency reserves. Furthermore, China in, "2013 had the world's second largest military budget following a decade and more of double digit increases in defense spending" (Foot, pp. 836). China's increased defense budget and additions to their military infrastructure/technology is creating an impactful example to the U.S. The potential for China to have a rivaling military in comparison to the U.S. showcases that they retain the ability to match them in a potential conflict. China's military improvements are sourced through their

developments into nuclear capabilities. "China will not allow the United States to achieve strategic primacy and is therefore increasing the size and sophistication of its ICBM force" (Fravel, pp. 23). Even if a potential conflict will not head towards a nuclear path, China's possession of nuclear weapons remains a serious threat and rivaling source of power to U.S. defense capabilities.

However, a better analysis of China's matching and eclipsing power over the United States can be witnessed in their trade-imbalance relationship. As the U.S. debt began to increase under China's borrowed funds, their economic dependency has become far more prevalent. The United States' critical strategy of initiating a trade war with China highlights further insight to suggest that China's economy may soon topple that of America. During the height of the recent trade war, "President Trump said the previous tariffs of 10% levied in US$200 billion worth of Chinese goods will be raised to 25%" (Liu, pp. 167). The United States' efforts to stall the advancement of the Chinese economy aggregates their potential threat to their defending hegemonic placement.

iii. China's Growing Dissatisfaction with the U.S.

China's rapid rise to power has shifted the scales of their economy and military infrastructure to eclipse the United States in total power. The final qualification for power transition to occur is that the rising power must become dissatisfied with the current system in place, and with the current dominant power. As China's power continues to expand, their efforts are being routed towards expanding their regional influence, especially in regards to Taiwan. As they have pushed for more territorial investment and ownership of the region of Taiwan, the United States has equally pushed back against China. This has created tension and dissatisfaction from China towards the U.S., as they believe they have more of a regional claim to the territory. China's dissatisfaction is stemming from the United States' lack of awareness of how to proceed in the region. While they are attempting to balance China's rising power, there is a concern from the U.S. in how to treat their ally of Taiwan. There are, "concerns about how to treat a democratic friend such as Taiwan and an authoritarian regime such as China which is rapidly rising and may potentially pose a serious threat" (Hsiegh, pp. 6). During the Bush administration, the United States resorted to continuing relations with Taiwan as a defensive pact against China's draw on the region. This administration believed, "that the United States must strengthen its diplomatic and military ties with Taiwan, even though such ties could disrupt the U.S.-China relations and regional stability" (Ross, pp. 52). The ongoing involvement of the United States into the affairs of Taiwan is furthering the development of dissatisfaction and conflict between them.

Additionally, China's dissatisfaction with U.S. involvement with Taiwan is creating a universal assumption that the relations in this region could be a proprietor in the creation of potential conflict between China and the U.S. China's dissatisfaction with the U.S. may resort to conflict in the region to finally change the pre-existing system of power in the international system. With the strategic placements of Chinese military in the Taiwan-Strait, "it appears primarily designed to give Beijing the means of contesting the US position at the top of the East Asian system" (Lim, pp. 284). It can be assumed that the rapid developments and modernization of the Chinese military in these regions can be a strong indication of their growing dissatisfaction with the U.S.

iv. Critique of Power Transition Theory

While power transition theory remains a prominent realist perspective and ideology, there are many scholars who suspect that its occurrence in international relations is circumstantial. "Power transitions involving leading powers are rare. They are hardly ever the result of gradual differences in economic growth rates, as power transition theories expect them to be" (Lebow, pp. 405). This rationale is derived from the conceptual perspective that China has already taken over the leadership role in the international community, thus, taking the United States' former position. This would contradict the primary focus of power transition theory, which iterates that a hegemonic shift has not happened yet, but will do so in the near future. Additionally, critiquing the objectivism of power transition theory contrats the sentiment that power transition wars occur in the absence of a preceding leading hegemon. Lebow ultimately found that the future outcome between the United States and China will not be a result of a power transition. "The greater risk is that conflict will result from the misperception that such a transition is imminent, and the miscalculation by decision makers in the United States (or China) that China will soon be in a position to do what no state has done before – unilaterally dictate the rules of the international System" (Lebow, pp. 408).

v. Implications for Future Relations

China's culmination of rapid power, their ability to rival the United States, and their growing dissatisfaction with U.S. involvement envisions a conflict between these great powers is on the horizon. While the first two qualifications of power transition theory are independent of U.S. control, the final indication in the struggle of territorial claims of Taiwan presents a cautious flashpoint of interaction between them. China's power has not stopped expanding, and will only continue to rise in the future. Only the future can predict whether or not their power can fully engross the United States. America's involvement in Taiwan does not seek to stop any time soon, and their continued presence is causing an ideological disassociation by China in regards to their relationship with the U.S. If the implications of power transition theory stands to embrace current strategies and trajectories, conflict will arrive soon.

The influx of Chinese analysts' coverage of their power expansion strengthens the argument that conflict is inevitable. They argue that the inevitability of conflict is due to power transition's rationale to be deterministic by nature. "With their structural focus on anarchy or power hierarchies, mainstream Realist and power transition (PT) theories produce narratives that are highly deterministic, depicting great power conflicts as hard to escape" (Gries, p. 458). Additionally, the argument that a power struggle is likely to occur is reflected by the United States and China possessing opposing strategic goals, both internally and externally. If this theory comes to fruition, China's dissatisfaction, as previously mentioned, may be the causing root of palpable conflict between these nations. While other theories of international relations might see cooperation as a possible outcome in the highlighted points of interests of power transition, they tend to avoid the psychology of the rising state, such as China, in said matters. Power transition ultimately maintains the pessimistic outlook that rising points of tension between the United States and China can only lead to conflict. From this angle, the vulnerability of the United States in relations to China's rising dominance creates a unanimous realist perspective that the hierarchical order will soon shift.

b. Perspective Two: Balance of Power Theory

In this perspective, the various qualifying factors of the United States' strategy will be evaluated to exhibit the balance of power perspective. From this perspective, the United States is: securing their own survival in preparing themselves against China's rise, formulating external alliances to increase their international presence, and emulating similar power forces against China in the hopes of balancing their rise so they do not reach threatening hegemonic levels.

i. Security + Hegemony

The United States has maintained a substantial history in developing policy and strategies with the goal of self-preservation. The rising threat in China's rise to power presents a unique challenge to the U.S. as they seek to implement policies to help sustain their position in the international community and their own survival. The U.S. began to take awareness of China's rising threat based on their developments in East Asia. Feeling the threat of China, the United States has attempted to strengthen their own national security strategies and empower their military capabilities in preparation for any potential outcome. "Ongoing modernization of US defense capability has been especially important for balancing the rise of China" (Ross, pp. 32). The U.S. has expanded their defense capabilities by strengthening their presence in regions such as the Philippines and Malaysia. Ross examined that the U.S. had increased their military fundings from two-million to one-hundred twenty million in these regions. Furthermore, the severity of the United States' goals to strengthen its security strategies results in their official departure of international goals in favor of an official 'pivot' towards China. This was a direct international policy approach under the Obama Administration to defensively prepare them for the rising threat of China. By making their view of China's rising power official, the United States is giving substantial and reasonable acknowledgement of these developments. These guidelines for looking to secure U.S. strategy are supported in the 2015 National Security Report. "The document calls for 'collective action' and a promotion of "international rules and norms" to ensure security and order against current threats" (Goldgeier, pp. 37). The goals of the U.S. strategy report intends to retain their international power, avoid military conflict, and develop strategies by forming alliances with other nations. The United States' international acknowledgement of China's threatening power, and the development of their military/national security strategies provides the footsteps for their goal to balance the rising hegemon.

ii. Internal + External Balancing

The United States has developed multiple partnerships and alliances with many Asian countries to assert their regional balance as a balance to China's power. The growing rise of China created the need for allying partnerships to strengthen their position in the international community. Maintaining these alliances not only builds the internal security of the U.S., but also helps to implement an external balance of power in the region.

These alliances with the U.S. serve as a source of insurance and protection against the threat of the rising state of China. This insurance of protection mutually benefits partnerships of the alliance. " The allies invest for such benefits with arrangements to ensure alliance preservation against challenges that arise as a result of alliance mismanagement" (Park, pp. 343). These alliances provide both internal and external strength to provide a balance towards the rising power. In a mutual and cumulative alliance, the relationship becomes too large and dependent to topple. The United States' pursuit of alliances with other Asian nations would not only create security, but it would also provide leverage in their challenging interactions with China. "The preponderant power of the US in Asia would give the US more leverage to construct any rules and norms it preferred and to punish any free-riding behavior without facing substantial resistance and challenge due to the huge power asymmetry between the United States and other Asian countries" (He, pp. 171).

The alliances that the United States has formed include: Thailand, Korea, Taiwan, and South Vietnam. Many of these alliances were formed from military contributions from the United States in the support of those nations. Even though the United States has been forced to decrease their engagements with these nations to a certain degree, the remaining alliance still imposes their regional assertion into their external presence. Maintaining these alliances is mutually administered to prevent the takeover of the rising power in the international community. "The United States and its regional allies wish to insure the status quo US-led regional order against unspecified adversaries" (Park, pp. 4). As the United States formed and maintained external alliances, not only is their internal security preserved, but their international presence becomes multi-faceted in an attempt to block China's rising power in their own region.

iii. Emulation

The United States has adopted power-generating practices in an attempt to balance China's power in the Asia-Pacific region. After the United States has properly identified the growing threat in China's rise to power and established external alliances with nations to improve their own national security, they have begun to emulate physical strategies to assert their presence to China. This can be witnessed in the United States' increasing deployment of troops and vessels in the Asia-Pacific region. This increase has been issued as a direct response to China's growing interest and military presence in the region. The most critical aspect to balancing China's power is to equally match and rival the physical power and presence of the growing hegemon. To the United States, this region has become both pivotal and critical to balancing the development of China as a result of the resources laid throughout this region. "The emergence of the Asia-Pacific is reflected in the regions high economic growth and large volume of maritime trade" (Prabhakar, pp. 232). China seeks to extend their rise in power through the undertaking of these resources to push their international influence to the next level.

Furthermore, it is important to note that the developments in this region are important to the United States based on the geographic implications it conveys of general strength and power by China. China's assertion in this region signals to the United States the strategic course it needs to implement to provide more or less concerning balancing policies. "Within the Asia-Pacific region, Northeast Asia is unquestionably the most vital region in assessing

power in all of its dimensions and in seeking to estimate the relative strength of real or potential contenders for influence" (Scalapino, pp. 374). With China evolving its strategic military deployments, the United States is deploying equally measurable power to balance out their prominence in the region. With these developments, the United States is hoping to sustain large enough levels of balancing power and strategy to shift the dynamic in their relationship with China. "The Asia–Pacific region has become a test ground to determine whether China and the United States can build a new model of big power relations" (Zhao, pp. 382). The only hope for successful balancing remains in the United States re-evaluation of their military imposition in the region in response to China.

iv. Critique of Balance of Power Theory

William Wohlforth's assessment and dictation of balance of power theory has set a precedent, and as such, many scholars have critiqued his views and of the theory itself. There is a growing consensus in the academic community that Wohlforth provided a mischaracterization of balance of power theory. "To counter what they describe as a universalistic balancing proposition, the Wohlforth team offers a set of generic hypotheses regarding collective action problems, domestic-level constraints on emulation and uncertainty" (Eilstrup-Sangiovanni, pp. 363). Wohlforth's insights into balance of power theory is out of date, to some, as it fails to address many contemporary points of interest in international relations analysis. Some factors of analysis that were left out by Wohlforth that many critics argue are critical to the U.S./China relations are: social cohesion, velocity of economic growth, and technological advancement. There is a growing academic sentiment that balance of power theory should be applied in the modern day to reflect the utilization of land-based military force. Even analyzing the context of world politics against the scope of balance of power theory, it does not provide a fundamental means of testing for U.S. and Chinese power. Ultimately, the shortcoming in Wohlforth's deduction is the lack of awareness of insight that studying the current international system can provide in analyzing the U.S./China relationship.

v. Implications for Future Relations

The nature of balance-of-power theory in the investigation of the U.S./China relationship presents that they will not arrive at conflict. The course of U.S. actions, strategies, and policies appropriately represents the qualifying foundations of balance-of-power theory presented by William Wohlforth. From this realist perspective, the United States is seeking to mostly protect their own interests through the course of forming alliances and emulating China's rising power against them. If this perspective is accepted, this course of ideology and strategy will outweigh any other, and most importantly, outweigh China's rising power with the United States' force of balancing. If the United States' can continue to implement effective balancing strategies, both in their interactions in the Asian Pacific, creating further external alliances in the name of developing their own national security, a war will not arrive between China and the U.S.

Realists who prescribe to the balance of power perspective maintain that it is dependent on the United States' ability to maintain and uphold balancing strategies against China to resort in cooperative peace. Demonstrating to the international arena that

the United States can effectively balance China's rise in power will exhibit a new model relationship. Suisheng Zhao argued that, "The new model can be built only if China and the US demonstrate a strategic restraint and maintain a delicate balance of power to prevent their rivalry from boiling over into a new Cold War" (p. 377). The United States involvement in the Asia-Pacific region presents an optimal and necessary platform to demonstrate their own balancing capabilities. While the situation remains delicate in their interactions with China, this platform can easily push the U.S. and China relationship towards cooperative peace. This is why realists succumb to the balance of power perspective: the opportunity presented to the United States in this political arena can help shape peaceful relations with China. It does not remain without challenges, however, as the future depends on effective strategies and policy implementations by the United States. It also requires insightful investigations and analysis of future tactics deployed by China. As it stands, balance of power theory can applicatively suggest that peaceful and cooperative relations between the United States and China are not only possible, but probable. The security of the relationship between these nations rests upon the politically insightful behavior of the United States and of China.

Conclusion

The results from the analysis will be concluded within the context of the arguments and questions originally presented in this thesis. It will first evaluate the main argument of the thesis before diving into the sub-questions. Further research will conclude the research for future insight into U.S./China relations.

a. Main Argument
-Are the evolving strategies of China and the United States leading toward inevitable conflict or cooperative peace?

As in any case of theoretical prediction, the answer is varied, and can be traced to two very opposing perspectives of outcome outlined through power transition and balance of power theories. Power transition theory outlays an inevitable path between the United States and China that leads to conflict, while balance of power theory alludes to the possibility of cooperative peace in their relationship. Despite this very different opposing conceptions of theoretical outcome, it is important to establish that both are rational assessments that have considerable merit in the academic community. Both outcomes can be reliable predictions of future relations, and their continued merits will rely on the intricacies and developments of the U.S. and China partnership.

Realists who ascribe their beliefs toward the power transition perspective highlight that the rise of China will ultimately pave the way for long-term and devestating conflict with the United States. A.F.K. Organski provided the original outline for power transition theory, and the requirements that will exhibit its existence in international relations. Organski's assessment of this perspective first predicted the potential for conflict, through the application of this theory, to occur between the United States and China. Since its origination, numerous scholars and experts have contributed to theory, and even offered their own findings and critiques. The overarching consensus, by applying power transition, exhibits that China's rising power is expanding to eclipse the United States. Additionally,

U.S. involvement in Taiwan upsets China to the point that they are considering the initiation of conflict between them. However, no theoretical argumentation is universally accepted, and critics fault that power transition conflicts rarely occur. Regardless, there is an imperative precedence that this ideological camp prescribes a near-future conflict.

As previously mentioned, the likelihood for conflict that is applied through power transition inversely creates the conditional potential for the United States and China to reach cooperative peace through balance of power. Assessing William Wohlforth's qualifications for a balance of power exhibition between great powers establishes the United States' attempt to balance China to avoid confrontation with them. With the assistance of other academic scholar's contributions to this theory, it becomes an acceptable case that gives considerable opportunity for these nations to arrive at peace. This is outlined through the United States' expansive external alliances, as well as their progressing attempt to prioritize their own internal security. Additionally, the U.S. position in the Asia-Pacific region highlights on-hand military strategy to physically balance China's expansion into other key aspects that will ultimately continue to grow their power. Just like power transitions, balance of power theorists have practical critiques that exhibit that this ideology is out of date and fails to consider contemporary aspects that are critical to assessing the future of U.S./China relations. Regardless, advocates of this perspective engage the possibility that the U.S. is actively pursuing balancing strategies, and that their probability for success will dispose them of any potential conflict with China.

As seen in the analysis of both power transition and balance of power theories, the evolving strategies of China and the United States maintain the possibility of both arriving at peace or conflict. This theoretical prediction cannot possibly provide a finite resolution or optimal outcome in concluding this research. The future of U.S. and China relations will continue to change due to the evolving policies, strategies, and tactics. Even the smallest implementations of these relational aspects can shift the balance of their relationship towards peace or conflict.

b. First Sub-Question
-Why is power transition and balance-of-power theory an applicative approach to studying U.S./China relations?

Power transition and balance of power theory maintains its prominence and usefulness in assessing U.S./China relations in realism ideology. Despite these theories resorting to different outcomes in the U.S./China relationship, these ideological principles remain as an applicative approach to examining two rivaling perspectives. Additionally, while there are further theoretical evaluations within the ideological camp of realism, these primary theories offer valid deduction that attests to the two most probable outcomes between their relationship: total conflict or cooperative peace. This thesis wished to offer two perspectives that completely rivaled each other in terms of potential outcome, and these theories offered that assessment. While their theoretical implications offered valuable overlapping in principle, the totality of their opposite deductions provided valuable and distinct perspectives. Power transition theory was able to offer the research the perspective that certain points of strategy and interaction between the United States and China was leading to an inevitable conflict between them. While on the other hand, balance-of-power

theories offered this thesis the rivaling view that the United States was attempting to balance China's expanding power to avoid conflict, and extend a lasting peace between them. With the theoretical proposal and assessment of the U.S./China relationship, it is important to offer at least two different points of view to engage with the prediction with critical assessment. The singular source of one perspective becomes too much of a prescription, and does not give as much credit to the prediction of the thesis without evaluating other points of view. Therefore, power transition and balance-of-power theories provided the necessary groundwork to analyzing and interpreting the dynamics of the relationship between the United States and China.

      c. Second Sub-Question
      -Is power transition or balance-of-power theory a more appropriate realist
      interpretation in studying the dynamics of the U.S./China relationship?

      With the different potential outcomes of these ideological perspectives, it remains challenging to pinpoint which interpretation of future outcome is more appropriate regarding the relationship between China and the United States. Through the examination, application, and critique of power transition and balance of power theories, there remains substantial evidence and prediction that creates a convincing argument that their relationship can head towards either outcome that these theories propose. Through the analysis of this thesis, both the United States and China are capable of opposing or supporting each other through keen points of interaction, such as in Taiwan or the Asia-Pacific region. The main idealisms of realism composes and highlights the competitive side of international relations, and both these theories act as opposing pathways sto managing the conflicts of their relationship. As it stands in their relationship, the United States and China possess an indifferent stance of possible outcomes towards each other. With the future development of strategy and policies, it is possible that either power transition or balance of power theories can become a more appropriate assessment in studying the dynamics of their relationship. But as it stands, the uncertainty and rising tension of their relationship creates the optimal analyzation opportunity for this thesis to present that both these ideological philosophies possess useful tools for imagining their future potential of peace or conflict.

      d. Further Research

      As examined, the theoretical applications of I.R. propose some significant and challenging contributions to understanding future relations between China and the U.S. In the evaluation of power transition and balance of power theory, their ideological deductions envision the U.S./China 's relationship to divide into two very different outcomes. Further collection of evidence can only help contribute to provide additional context and analysis for theoretical investigation. This evidence of the future can be further scrutinized to evaluate developments in the various flashpoints of interactions mentioned in this research. The ongoing territorial debates of Taiwan and the military involvements of the South China Sea will continue to provide useful analysis and projection. Additionally, any new points of interaction between future U.S. presidential administrations and the People's Republic of China will add to the assessment of their relationship. The final and exact outcome of this research can not be concluded, unless these nations arrive at conflict. As long as they continue to serve peacefully or cooperatively with each other, there is always the potential

for strife in their relationship. Until better analytical tools are developed, theoretical ideology is the most useful source of examination in inferring the outcome of the relationship between the U.S. and China.

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Sun   **Financial Inclusivity Through Decentralized Finance and E-gifting**
Chuanen

Abstract

With the emergence of distributed ledger technology in blockchain and the absence of an intermediary, Decentralized Finance (DeFi) is no doubt transforming traditional finance in many aspects. DeFi has given customers the opportunity to advance their financial situation by being able to participate in a nontraditional financial institution that opens doors for many people who normally do not qualify. It returns the freedom of choosing back into the hands of customers and opens the doors to a future of financial freedom. DeFi is also part of a broader and constantly changing forefront of financial technology that provides a freedom to choose who customers exchange and receive payment from. The lack of third-party intermediaries in DeFi provides a different framework that opens a new opportunity for consumer's socioeconomic advancement and shows increases in financial literacy to underrepresented individuals that do not have access to formal banking services. Likewise, E-Gifting provides an opportunity for involvement of financial service users who demonstrate unique situations that involve political resonance and controversy. Having a store-value currency in a digital gift card enables non-traditional financial users the opportunity to provide solutions to a variety of political issues such as immigration and lack of socioeconomic resources. The improvement of traditional finance by incorporating flexibility and transparency through DeFi services and digital gifting provides a gateway of opportunities for individuals with a variety of backgrounds to attain financial efficiency. This paper explores how DeFi and E-Gifting provide an opportunity to increase transparency, inclusivity, and bank-style resources.

The Importance of Financial Inclusion

Financial inclusion is a way of self-sufficiency in which adults have access to financial services in which they feel their assets are safe. Convenient access to affordable and basic finance helps groups of underrepresented individuals. These groups of people typically live-in low-income areas. Most of this demographic are women. Ways that these individuals take form instead of having more accessible financial tools is living without a bank account, is turning to alternative financial accounts which have higher fees, and do not offer consumer protection which makes them more likely to lose their assets. Additionally, the lack of opportunities to build credit takes a toll on lower income communities. Without the ability to take out a loan, limits the flexibility that an individual has with their own financial freedom and the ability to have a stable financial future.

Lacking proper financial services to better their self-sustainability can put women at a risk of staying in unfavorable situations with domestic abuse. According to an academic study written by Dana Harrington Conner discusses how, "financial impediments come from a history of inequality which results in prolonged domestic abuse because of lack of faculties" (Conner, 2014). Additionally, because of the COVID-19 pandemic, financial freedom has become a more important topic than before. Financial uncertainty that came along with the pandemic not having a stable timeframe of when it would come under control was a pressuring financial issue, especially if a loved one was affected with COVID-19. Job loss and pay cuts during the pandemic urged individuals to become more financially

independent, although at the moment, besides mainstream banks, other methods were not possible, until decentralized finance and e-gifting.

General Outlook on Decentralized Finance (DeFi)

Decentralized Finance (DeFi) is part of a broader evolving digital economy that is reconfiguring traditional finance based on blockchain technologies. It replicates existing financial services in a more open and transparent way. In particular, DeFi does not rely on intermediaries and centralized institutions. Instead, it is based on open protocols and decentralized applications. (Schär, 2020) As a result, DeFi creates a very transparent and inclusive financial system across different industries. The market currently consists of a large variety of companies that have invested in the following financial platforms.

The DeFi industry is currently experiencing an incredible surge. More than two billion of US dollars have been deployed across a variety of DeFi applications that offer lending and borrowing services. A view on this upcoming financial technology is taken by providing a preliminary research review on aspects that DeFi affects or has a lasting impression upon. In previous years, we concluded that there is a positive and rapidly increasing trendline of DeFi users, which skyrocketed due to the COVID-19 pandemic. Although DeFi is still a niche market, the volumes are growing rapidly. The value of funds that are locked in DeFi-related smart contracts recently crossed 10 billion USD. (Schär, 2020) By analyzing other research done on the topic, we are able to attempt to define what DeFi is and why it should and possibly will be the future of financial technology in the near future.
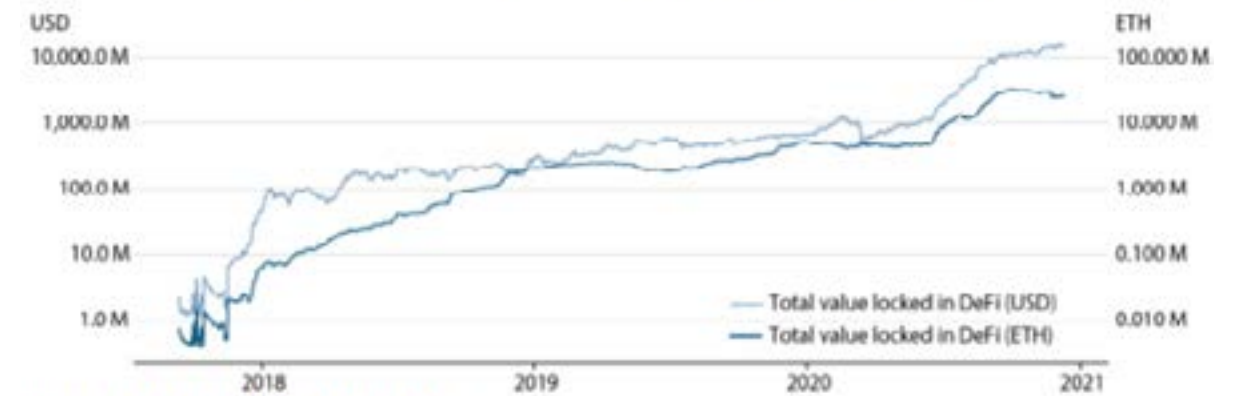
(Source: DeFi Pulse, Schär, 2020)

Contrast Between the Decentralized Finance and the Traditional Centralized Systems

It is important to see the difference between DeFi and traditional FinTech. The primary difference is that traditional financing is centralized. Centralization in FinTech is shown as "hubs" or in the form of clustering in regional, and global access points. In addition, the traditional FinTech has intermediaries, which range from banks to market providers who bring together a wide range of participants. It brings together a large array of financial participants savers, lenders, borrowers, investors etc. (Zetzsche, 2020) The intermediary point is then seen as another major source of centralization.

DeFi, on the other hand, challenges the hub logic. It eliminates the need to adjust in terms of language and law and subscribes to the high compliance standards reflecting the concentration of risks, information costs. The emerging market currencies, for instance, services could be tokenized and provided to the token holder regardless of places of origin of provider and recipient, with Bitcoin a prominent example -Bitcoin holders are linked through common technology rather than a massive balance sheet in a highly regulated payment hub. (Zetzsche, 2020)

Blockchain and its Relationship to DeFi

Blockchain, also known as the founding chapter of cryptocurrencies, such as Bitcoin, is a form of technology that uses "blocks" or uniquely identifies transaction records and orders them in a chain. Blockchains are always growing, in the form of blocks. It is the root of DeFi because the systems that use blockchain do not require a central server and therefore do not depend on the market for their main point of success. There are two main components in blockchain: distributed-ledger technology (DLT) and smart contracts. Distributed-ledger technology supports the idea of decentralization. It shares, replicates, and synchronizes records of transactions between contracting parties secured by cryptographic sealing. The DLT gives opportunities for those that seek to avoid third parties. Not all distributed ledgers are blockchains, but all blockchains are distributed ledgers. The smart contracts constitute the rules that participants have collectively agreed upon to govern the evolution of "facts" in the distributed ledger. It ensures every transaction with an underlying legal agreement. (Nofer, 2017)

Blockchains are transparent because all changes in the transaction can be seen by both parties. Therefore, blockchain technology creates a simple, more accessible software in which there are clear records of agreements and transactions, that creates the fundamental basis for software like Bitcoin, the first decentralized technology digital currency. This shift also signifies big changes within the FinTech industry. Blockchain extends into political, humanitarian and social aspects as the formation of blockchain forms the beginning of DeFi. As a result, DeFi opens the financial markets to a lot of more sources of revenue by taking away the barriers of the formalities of financial technology; Blockchain sets the basis for decentralized financial technology as they represent similar aspects to the idea of diversifying the classic idea of financial technology.

Differences in Regulation Leads to Financial Inclusivity in DeFi

Only a small number of jurisdictions have started to regulate DeFi. Regulators in many countries are still struggling with regulatory questions regarding crypto assets. Due to the global hubs being at the will of the market, such as the conversion rates being a main factor in global investment, is a weakness of traditional financial technology. These centralized hubs are at the will of the health of the market and exchange rates. A market failure can lead to the demise of centralized financial technology. This is where DeFi leads with its message of FinTech being independent of a need for dominant intermediaries in financial transactions. In emerging countries, by implementing DeFi into one of the options for financial literacy, will be able to provide a banking-style system to more than 1.7 billion adults, according to the World Bank (IBRD/IRA), who stay without access to a formal financial system. DeFi in FinTech introduced the message taking out the need for humans in a purely digital conversion of money. Since the placement of DeFi in financial technology subtracts the need for intermediaries such as global level scale banks, this will allow more countries to join and be able to have complete access to the financial services offered.

The Future of Decentralized Finance

The blockchain-powered space of Decentralized Finance is no doubt still in its very early days. In 2020, the monthly number of DeFi users ranged between 40,000 – 60,000, with 90% using decentralized exchanges (Grigo, 2020) The reasons as to why DeFi is considered the future of fintech is because of the different mindset that it has on the FinTech frontier. DeFi is seen as the bridge to democratizing financial services and becoming completely inclusive to developing countries as well as all types of people to be able to participate in FinTech such as mobile payment, cryptocurrency, cross-border e-gifting, etc. Openness is a very important factor to financial technology. DeFi offers a huge disruptive potential and a very compelling value proposition whereby individuals and institutions make use of broader financial applications without the need for intermediaries. Because of restigant regulations on traditional financial services, someone who does not have a good financial situation, might not have the resources to improve. By using a software like Etherscan, financial transactions can be easily traced and taken note of. This differs completely from traditional financing as they are controlled by major institutions.

Inclusivity in E-Gifting

Other types of financial opportunities that also open up possibilities for people that aren't represented in traditional finance are digital gifting, also known as e-gifting. E-gifting is the concept of having digital prepaid gift cards available for purchase. These digital gift cards store value and can be attained as rewards or in general to have a new alternative financial means used in a lot of different ways. The use of e-gifting brings new opportunities to underrepresented situations in finance due to the entanglement of socio-economic issues. Additionally, the e-gifting industry has skyrocketed due to the digitization for a lot of shopping services with the COVID-19 pandemic. Particularly in the United States, the gift card market has recorded a CAGR of 29.1% during 2015-2019. The e-gift card industry is projected to grow over the forecast period and is expected to record a CAGR of 18.1% during 2020-2024. The e-gift card market in the country is estimated to reach US$ 101,979.2 million by 2024. (Research and Market, 2020) E-gift cards are mostly used by the younger generation. Therefore, the industry is expected to face rapid growth in the future. Most Millennials (72%) say they used e-gift cards and have also tried other payment methods such as mobile apps (60%), gift cards in mobile wallets (44%), and mobile wallets (42%). (K, Jaqi, 2020)
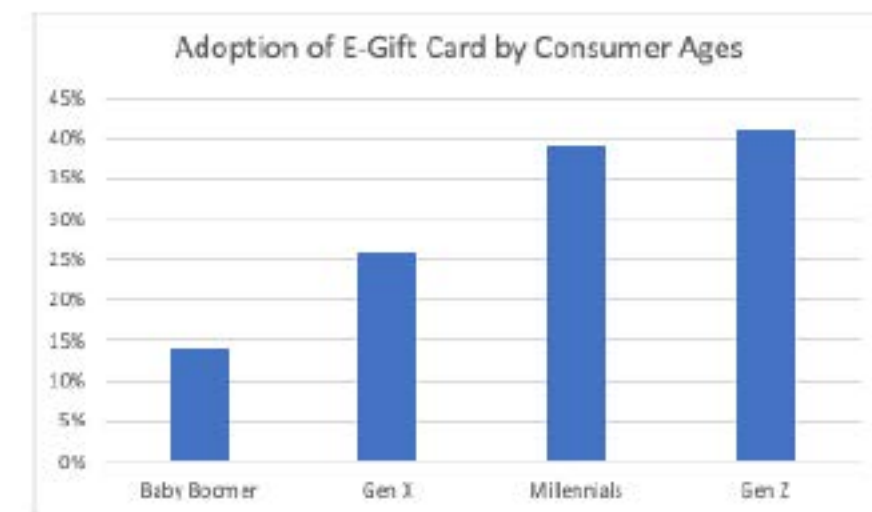

(Source: Wonder)

To further analyze e-gifting usefulness in having a future for financial inclusivity, we took a case study with a Canadian-based company named Centigram in which we studied multiple international jurisdictions such as Mexico, India, Philippines and the United States and their e-gifting market. During this case-study we organized integration plans taking into consideration e-gifting's market as well as technological application that is usual in each geographic area.

Status of E-Gifting Regulations in the United States after Covid-19

"The COVID-19 pandemic has resulted in over 4.3 million confirmed cases and over 290,000 deaths globally" (Nicola, 2020). It has also sparked fears of an impending economic crisis and recession. Social distancing, self-isolation and travel restrictions have led to a reduced workforce across all economic sectors and caused many jobs to be lost. Schools have closed down, and the need for commodities and manufactured products has

decreased. In contrast, the need for medical supplies has significantly increased. The food sector is also facing an increased demand due to panic-buying and stockpiling of food products. In response to this global outbreak, we summarize the socio-economic effects of COVID-19 on individual aspects of the world economy. In the finance industry, COVID-19 has affected communities, businesses and organizations globally, inadvertently affecting the financial markets and the global economy. Uncoordinated governmental responses and lockdowns have led to a disruption in the supply chain.

The COVID-19 crisis accelerated the expansion of e-commerce towards new firms, customers and types of products. It has provided customers with access to a significant variety of products from the convenience and safety of their homes and has enabled firms to continue operation in spite of contact restrictions and other confinement measures.
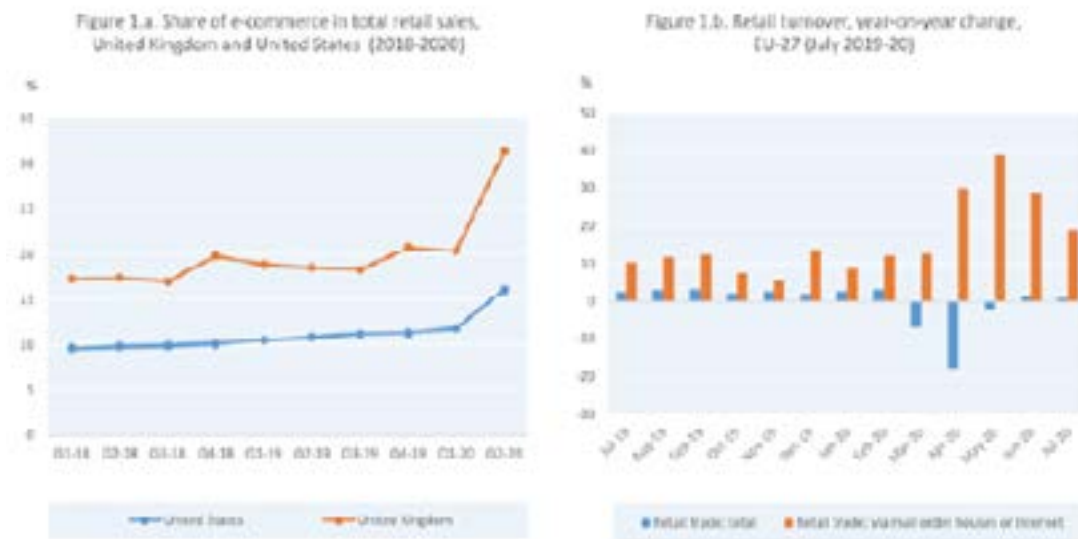
(Source: US Census Bureau, the Office for National Statistics in the UK and Eurostat)

Because of the recent growth in the e-commerce industry, e-gifting is on the rise now more than ever and is projected to increase substantially with each coming year. E-gifting is becoming a way to digital source of financial freedom for individuals to exchange currency digitally, a resourceful and much needed financial tool with the isolation that COVID-19 brought.

Socio-Economic Issues Reflected Through Financial Solutions

Immigration brings into the question of whether individuals who do not have a legal title or citizenship within the United States can have equal means to access financial services to take care of the family that they still have a primary care over in their home country. According to a Brookings research foundation report about immigrants in the United States and their need for independent finances, "In 2002 alone, immigrants living in the United States sent $25 billion to relatives living in Latin America and the Caribbean" (Paulson, Anna). Similarly, in DeFi, e-gifting allows individuals to take their finances into their own hands without massive government intervention and allows them to cater to specific financial services that are available in their home country and send them digital gift cards for

the commercial chains that are prevalent in their country of origin. By having a digitized access to this prepaid financial service, they are able to send money to their family without having to travel or pay any additional fees to support their families in any way that they could as well. Financial inclusivity is a big factor that unites DeFi and e-gifting services together and allows them to include a vast number of financial services for a large pool of consumers that would typically not be available in traditional finance.

E-Gifting Becomes Financially Inclusive

International money transferring is a difficult task to achieve when the individual in question does not have access to a regular bank account, and if their family or person of interest the foreign country does also not have regular access to a bank account. The lack of accessibility for these kinds of situations has led to family misalignments and separations that could be fixed with a more inclusive environment that decentralized finance and e-gifting could help achieve if it was implemented more often.

Although e-gifting is more commonly used as prepaid digital codes in which a user could simple just get the code that family member sent over and do their shopping online while using their gift card as a form of digital cash, e-gifting has the potential to become a new inclusive way to for individuals who do not have access to traditional financial services to support their families from abroad. This decentralized form of sending money is a new and efficient way to include more individuals into an inclusive financial environment.

Decentralized Financial Technology and E-Gifting As Financial Inclusive Tools

In conclusion, due to DeFi's difficulty to measure a field of finance as new as that one, we took a case study with a Canadian-based company named Centigram in which we studied multiple international jurisdictions such as Mexico, India, Philippines and the United States and their e-gifting market. This research concludes that the current market trends were with e-gifting in the United States and concluded it was becoming a flexible enough option to be applied to a large variety of situations such as immigration and non-traditional financial resources.

In this way, individuals that do not have a stable means of having a traditional access to a bank account and decide to seek other services, at least have the options to better their probabilities to have financial freedom and have the opportunity to better themselves. With the help of FinTech in digital payments and transactions, cross-border e-gifting and decentralized exchange became possible. E-gifting and decentralized methods of financing opens up doors to possibilities in which a more stable financial future can be attainable, especially with urgent issues that life can throw such as the COVID-19 pandemic. Financial literacy, accessibility, and transparency have become a major influence as to why individuals are preferring non centralized methods of payment and investing. Taking control of their financial future is becoming more inclusive than it has ever been.

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Tacadena   **Juvenile Justice Reform in California**
Danica
Abstract

        Juvenile justice reform aims to create efforts that use detention, out-of-home placements, limiting their serving time, and general support for youth. Reforming the system would further prevent youth's mistakes from future barriers that prohibit life opportunities and reintegrate them into society. Consequently, there is a link between education exclusion and the criminalization of youth. The disproportionate influence of school disciplinary policies continue to push youth of color out of school and toward incarceration at an extreme rate. This is called the school-toprison pipeline. This article will examine dismantling the school-to-prison pipeline by eliminating zero tolerance, personal efficacy and systemic change, community support and youth engagement. The juvenile justice system has juggled between rehabilitative and punitive approaches to managing young offenders. Racial minorities, especially African American males, are affected and criminalized by this system. There are racial disparities in the juvenile justice system, known as disproportionate minority contact (DMC). Inequality in the juvenile justice system is very prominent in the U.S., and the system's framework is built upon these prejudices. This article discusses the historical racial disparities that exists in the juvenile justice system and the distinct difference in treatment. The juvenile justice system in California is designed to handle all circumstances concerning juvenile law, which includes juvenile justice and delinquency cases and proceedings. This article will focus on the structure of juvenile sentencing and what society should do to reintegrate youth in California. The goals of juvenile sentencing in California are rehabilitation, limiting custodial sentences, and avoiding unwarranted disparities.

Introduction

        A juvenile court's aim is to initiate rehabilitation and reform toward delinquent youth in place of pressing punishments. Juvenile justice reform calls for needed policy reform, public education efforts, prevention efforts, and restorative approaches. Juvenile justice focuses on inflicting punishment for their crime instead of developmental mechanisms that are instrumental in prevention of youth crime at an early stage. Youth have different backgrounds, face various challenges, and require specific services and support. Most juvenile acts are committed due to personal situations and factors like family, mental stability, individuality, and substance abuse. These acts lead to long periods of time served in prison with little to no reform of the incarcerated individual. As the educational system and juvenile justice system are at a crossroad, reform is much needed. A change in environment, positive interactions with peers, and having a preoccupied mind can prevent juvenile crimes.

        There are processes and events that show discriminations against youth of color as they are affected more adversely and disciplined harsher (Hirschfield, 2018). It not only happens in the juvenile justice system but it starts in a school setting. There is a strong relationship between educational attainment and youth's outcome. Rather than finding corrective approaches and understanding youth (family structure, parenting, social and community involvement) to prevent negative behavior, schools lean toward disciplinary actions like expulsion and suspension. The incarceration of youth, especially young men of color, is a result of failure in our educational system. Populations of color are oppressed in an educational setting and after having the unfair struggle to reenter society when imprisoned.

        While much attention has been given to the School-to-Prison Pipeline, the Prison Education Project (PEP) has established a Prison-to-School Pipeline. According to PEP's website, the goal of PEP is to educate, empower, and reintegrate incarcerated individuals into society. In creating a Prison-to-School Pipeline, in-custody students are provided with the cognitive tools necessary to function as productive citizens (Reese, 2020). PEP has expanded educational opportunites remarkably.

        Youth of color endure much harsher punishment compared to nonminorities. There is a widening gap between blacks and whites in the juvenile justice system. Hence, there is the desire of change in rehabilitating youth in a substantially improved system rather than receiving disproportionate and prejudiced punishment. Racial disparities in the juvenile justice system are known as disproportionate minority contact (DMC) (McCoy and Pearson, 2019). DMC most commonly affects Black and Hispanic youth. Zero-tolerance in schools and proactive policing negatively contribute to DMC and the effort to reduce it. Youth of color experience the high risk factors that are associated with poor education, family, mental stability, individuality, and substance abuse more than whites. Consequently, minority youth penetrate the system at an excessive and disproportionate rate (differential treatment). Minority overrepresentation expresses the racial and ethnic differences (Bishop, 2005).

        The juvenile justice system in California has advanced their structure of juvenile sentencing and overall framework substantially. The system has slowly changed in regards to efforts made within the past decade. Some said reform changes are intended to provide structural change in an operational level. California has recognized the poor outcomes and the need for a greater crossover system between school and prison to correct negative outcomes for youth. Specific reforms in treatment and sentencing aim for the implementation of a more effective, rational, and humane justice system. Recently, data have prompted that enacting changes have reconstructed the juvenile justice system from what it was before.

The Juvenile Justice System

        Findings call for needed policy reform, public education efforts, prevention efforts, and restorative approaches. Together with these efforts, how have these sculpted and bettered the juvenile justice system? The juvenile justice system has transformed itself with advancements that lean toward a more effective, rational, and humane system. From 1974, Congress appointed the Juvenile Justice and Delinquency Prevention (JJDP) Act. The Juvenile Justice and Delinquency Prevention (JJDP) Act provided support to help and aid local and state agencies in preventing delinquency and improving the juvenile justice system (Robles-Ramamurthy and Watson, 2019). From then, probation systems have sought to lessen the stream of youth from probation to incarceration and be more lenient in their responses to violations. In introspective, the system has progressed slowly from what it was 20 years ago.

The School-to-Prison Pipeline. There is a clear correlation between the education system and juvenile justice system in a youth's outcome. California has taken action and made notable progression gradually between the years of 2012 and 2014 for advancements in the school-toprison pipeline. To begin with, zero tolerance policies in schools are applied for most disciplinary outcomes. They are commonly severe and punitive. These said policies are discouraging and mandate the education system to strictly punish students regardless of rationale and context. The incarceration of youth of color is the result of when schools decide to use suspension and expulsion for disciplinary action. Barriers like family structure, parenting, social and community involvement are not kept in mind. Many of these children additionally have disabilities and suffer from harsh histories of poverty, abuse, or neglect. The education system does not allow them to benefit from supportive services like counseling and are not generally given an understanding in a youth's misbehavior. Meanwhile, they are isolated, disciplined brutally, and dismissed.

In 2013, California pushed for schools to practice safety plans to construct a positive school climate and environment. This allowed youth to benefit from the removal of strict zero tolerance policies and limited the amount of suspensions and expulsions made. According to National Juvenile Network:

> The law authorizes the use of the plans as primary strategies for maintaining a positive school climate, and for prioritizing mental health and intervention services, restorative and transformative justice programs, and positive behavior interventions and support (National Juvenile Justice Network).

Although the trend of sending youth to prison because of minor infractions in schools has improved, the problem still persists. Studencs of color are pressingly vulnerable to this trend. Schools significantly contribute to disproportionate minority contact (DMC) with the juvenile justice system. In terms of DMC in an educational setting, a research study reflected that Blacks and Hispanics do not receive fair treatment in their early years when disciplined (Hirschfield, 2018). Race is a significant factor in disciplinary outcomes.

To be clear-cut, school disciplinary policies majorly affect black students. The American Civil Liberties Union reported that black students approximately 31% of school-related arrests. In emphasis, black students suffer from disciplinary outcomes like suspension and expulsion three times more than white students. When thinking about the school-to-prison pipeline, it can be seen that students that encounter these disciplinary outcomes are likely to face the juvenile justice system in the coming year. The overall approach towards this are restorative practices in the classroom to discipline. In a research study, restorative practices in the classroom revealed to have little influence in disciplining youth (Johnson, 2020). It is assessed in a classroom environment before and after the implementation of restorative practices. The intention and implementation of restorative justice practices is to reduce the school's role in the juvenile justice system. An example of a restorative justice principle, California expanded a ban on suspensions for willful defiance. Willful defiance included insignificant misbehaviors such as "sagging" pants, talking back, etc. Prior to this ban, students underwent suspension in retribution due to zero tolerance policies. This ban developed from the criminalization of youth of color and disproportionate minority contact in schools. For this reason, it has been acknowledged that this excessive

criminalization of youth in school can directly lead to the involvement of the juvenile justice system.

Addressing Racial Disparities and Unmet Needs. The juvenile justice system's framework is built upon social disparities and racial inequalities. The link of race and those incarcerated were examined and researched in relation to their injustice status; the system's framework is built upon these prejudices (Smith, 2017). As can be seen, minorities excessively penetrate the system at a disproportionate rate. One of the juvenile justice system's goals is to avoid unwarranted disparities. There are prejudices and mechanisms behind how race and ethnicity influences responses from the juvenile justice system. In regards to disportionate minority contact, California had passed the Racial and Identity Act of 2015. From a publication reporting, it describes the Racial and Identity Act of 2015:

> New legislation will strengthen the current racial profiling law in California by requiring every state and local law enforcement agency to collect data on all law enforcement stops of individuals and annually report this information to the Attorney General (National Juvenile Justice Network).

According to data released from the U.S. Department of Justice, it has provided knowledge of the early juvenile justice system with its racial inequality and discriminatory practices in response to youth crime. The Sentencing Project has also released a fact sheet with critical numbers that analyze the juvenile justice system since the start of the century. Through time, the gap between black and white youth widens (National Center for Juvenile Justice).

Figure 1
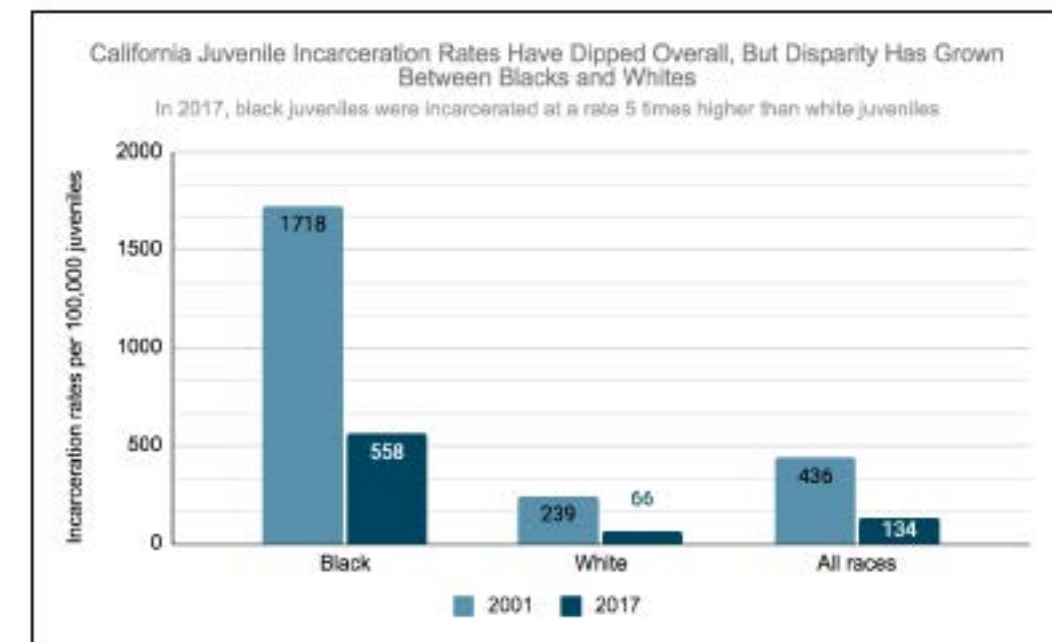
(Source: EZACJRP, Easy Access to the Census of Juveniles in Residential Placement: 1997-2017)

Moreover, there is no great difference in behavior between each other. Equally important, it is about the response given to those said behaviors and their race. In a study of youth risk behavior surveillance, results drew distinct lines between black and white youth. Notably, black youths are not commiting a greater number of crimes comparatively to white youth (Kann et al., 2018). To put into a heavier perspective, results presented that white youth are more likely to carry firearms, harsher drugs, and deal with alcohol as to black youth are more likely to get into fights, smoke, and handle on school grounds. From another interpretive study that traced racial inequality from school to prison, it documents how racial minorities, especially black males, are affected and criminalized by this system (school policy, shorten educational opportunities, etc.) (Simmons, 2009).

Advancements in Juvenile Justice Reform. Several developing reforms have been made in the effort to restructure the juvenile justice system toward a more effective, rational, and humane system. Restructuring juvenile justice in California has allowed for fewer youth to be incarcerated. According to recent numbers from the U.S. Department of Justice, there has been a significant lowering drop in overall youth incarceration rates. Being that, reform efforts made in California between 2012 and 2014 allowed for this lowering drop in overall youth incarceration.

Figure 2

(Source: California Department of Education)

The graph reports a substantial decrease within a period of time, using the Los Angeles Unified School District as a model. As of then and in recent years of 2017-18 alone, the drastic drop in suspensions in school were by sixfold which resulted in a better direction for the school-to-prison pipeline issue. With this in mind, the U.S. has lower numbers of youth being incarcerated but, racial disparities are still prevalent and existing with no significant change.

Advancing the system to further prevent youth's mistakes from barriers that prohibit

life opportunities and reintegrate them into society is one of the prime goals of the juvenile justice system and for those youth incarcerated. Accordingly in 2012, California passed a law that prohibits schools from denying youth from reentry who have come in contact with the juvenile justice system.

The Prison Education Project (PEP). In addition to this, there are programs that aid and assist in this matter specifically in California such as, The Prison Education Project (PEP). Youth in child welfare or juvenile justice systems are often deprived of the high quality education and social skills that are imperative to mold them into productive and functioning adults (Leone & Weinberg, 2010). In the first place, the school-to-prison pipeline is an extensive concern. The PEP is equal to turning off the "school-to-prison pipeline" and halting the non developing improvement in supporting youth. The PEP strongly encourages better education, empowerment, and reintegrating incarcerated individuals into society and it has also become the largest and withstanding program of its kind (Reese, 2020). As a matter of fact, the PEP provided incarcerated individuals with significant educational opportunities in California prisons. Together with the assistance of 800 university student volunteers from 12 universities, PEP provided Study Circles programming in the three Division of Juvenile Justice (DJJ) facilities: Ventura Youth Correctional Facility, N.A. Chaderjian Youth Correctional Facility, and the O.H. Close Youth Correctional Facility. Following this, the PEP then proposed a new College Readiness program into these three DJJ facilities. The new College Readiness Program would bring four core modules that would allow incarcerated youth the dynamics of being a well-rounded student such as: "Introduction to College", "Introduction to Soft Skills", "Career Development", and "Financial Literacy". Withstanding this new program, PEP's principles to use the resources of correctional facilities to make momentous change were in motion.

Two courses per semester (Spring, Summer, and Fall) will take place at each facility and each course will be 90-minutes in duration offered once per week. In the "Introduction to College" course, youth will be taught and assisted on their personal statements for college, the college application process, and Pell Grant financial aid applications. This course will also help explore vocations and careers, community college assessments exams, work productive strategies (time management, outlines, etc.), getting involved in college, and overcoming the challenges. Afterwards, the "Introduction to Soft Skills" course will introduce in-custody students the importance of soft skills. For example, youth will be advised on communication skills such as face-to-face interaction, humor, small talk, body language, and nonverbal communication. As this course continues, the material will support their overall personality, adaptability, innovative thinking, and punctuality. The "Career Development" course introduces career development practices. These career development practices include acquiring the essentials (life skills, nestworking, and soft skills), proposing beneficial life-long opportunities, and developing a resume. Next, the "Financial Literacy" course offers the concept of financial literacy with ideas of working, making money, and debt management. Instruction on the principles of the concept of entrepreneurship, opening a bank account and writing checks, saving money, the importance of credit, and buying a house or apartment will be shown. Altogether, the incarcerated students will benefit from this knowledge and are not deprived of the education and social skills that are imperative to mold them into productive and functioning adults. The youth participants will then describe their experiences and whether the modules were impactful after the program. A program

evaluation survey that contains five questions about the impact the program held and how the courses would help them when they paroled. Under this program, the DJJ-to-college pipeline will come into actuality and youth will be inclined to becoming responsible, educated, and productive citizens in society.

DJJ (Division of Juvenile Justice) Innovative Program. The Division of Juvenile Justice (DJJ) is a part of the California Department of Corrections and Rehabilitation system. DJJ provides education and treatment to youth individuals up to the age of 25. Youth are sent to DJJ facilities with the intention of achieving community restoration, victim restoration, and offender training and treatment. The DJJ Innovative Program requests for applications and proposals to involve youth, staff, families, and volunteers to collaborate with DJJ to support youth incarcerated. Provided that, DJJ will supply a total of $1.5 million in grants to fund Innovative Programs. As a result with this support, youth are prepared for a sharpened return to the community and society after a period of confinement. Through the DJJ Innovative Program, the Prison Education Project (PEP) was awarded the funding opportunity and grant to establish a new College Readiness program into the three DJJ facilities. Correspondingly, PEP courses in the past have demonstrated to be beneficial because it reduced behavioral misconduct in facilities. With the grant support, PEP will continue to integrate offender responsibility, a reduction in criminal behavior, resiliency, and restorative justice principles. This grant will invest towards the goal of creating the DJJ-to-college pipeline. Up to the present time, DJJ will begin closure of their facilities. The decision for closure was steered by several factors which included "attrition trends, categories of juvenile offenders, and available staffing and program resources". The DJJ will dissolve and transition into the California Health and Human Services Agency (CHHS) as the Department of Youth and Community Restoration (YCR).

Outcomes

The "Introduction to College" data are the aggregate responses from one of the four course modules that were taught in the College Readiness Program. The "Introduction to Financial Literacy" and "Career Development Course" data are the aggregate responses of the other two courses taught. There was an open-ended response from each person that completed the program evaluation survey. The author included a selection of responses per course.


Figure 1 PEP DJJ: College Readiness Program - "Introduction to College", Fall 2018
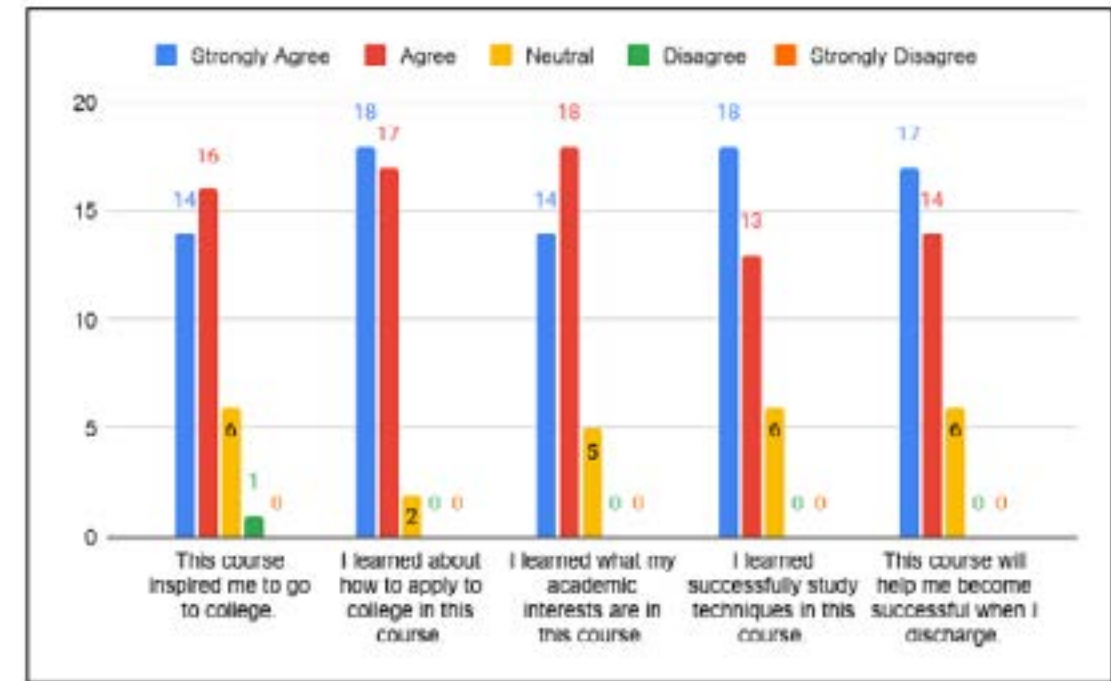
Introduction to College Post-Course Comments
• "I always wanted to go to college but I didn't know I could do it. Thank you everyone for coming and thank you for the shirts."
• "Y'all inspired me to improve myself. Thank you for coming to teach us about college."
• "Thank you for sharing your knowledge with us here that are incarcerated. It shows that people care about us."
• "At first I didn't care about this course. I would just come for the heck of it to get off my unit. It was good to be around college students who want to be successful."
• "This is a very good resourceful program."
• "The volunteers were very helpful and open with us. I thoroughly enjoyed the program and look forward to participating in the future events and sessions."
• "Thanks for the opportunity. This course helped me gain more knowledge about college and applying to college."

Figure 2 *PEP-DJJ: College Readiness Program - "Introduction to Financial Literacy", Winter 2019*
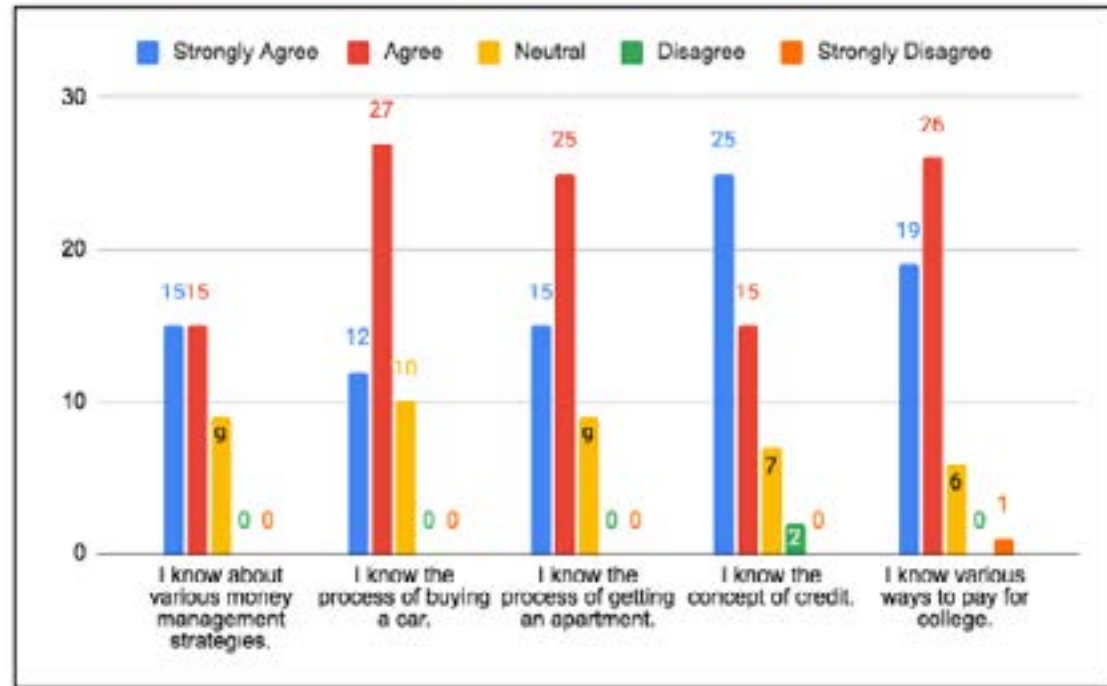
Introduction to Financial Literacy Post-Course Comments

- "This class was very helpful. Without it I would've been lost returning to the community in terms of financial things. I hope we can review more classes about this."
- "This class was very helpful and gave me a little bit of insight, I think they should continue this class especially for young people who will be released to the community."
- "I feel like this class was very helpful and it gave me a lot of tips on life. I hope eventually we can get longer classes, it would be real helpful."
- "That it was very helpful. It gave me some insight to what I'm going to face on the outside."
- "It is a good class. Opened my eyes to different things. It is educating us on college and life lessons and can use when we are released."
- "It helped me to understand the process of buying a car and paying for college. Also, it taught me how to save."

Figure 3 *PEP-DJJ: College Readiness Program - "Career Development Course", Spring 2019*
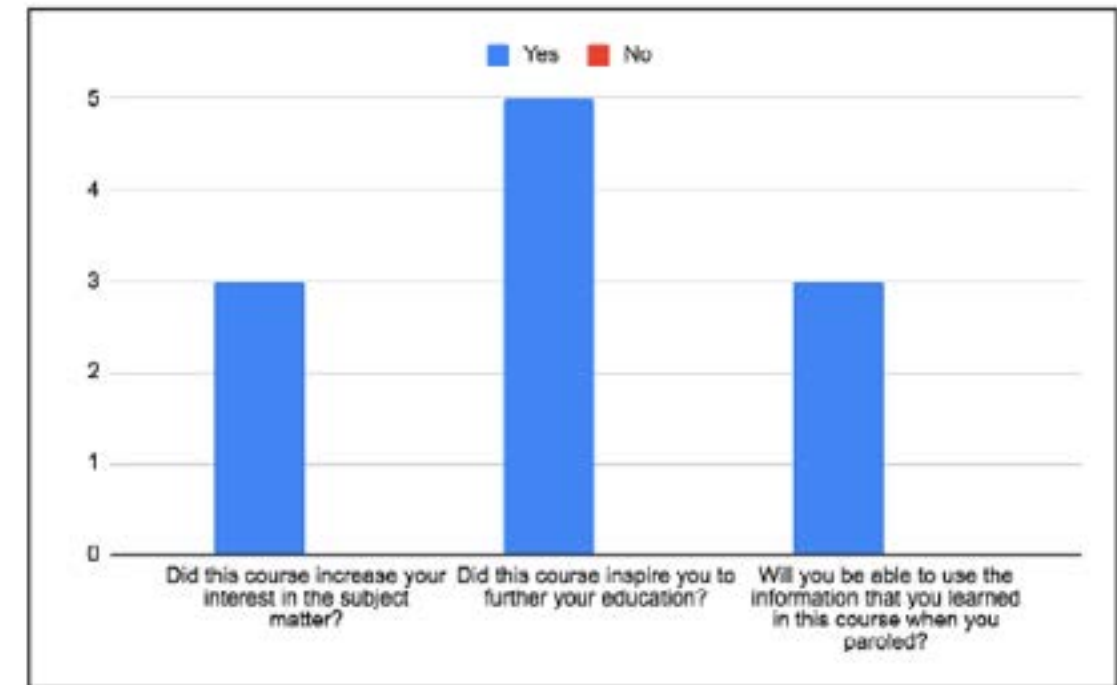
Career Development Course Post-Course Comments

- "Helps you have an idea of what careers are available and how you can use your resources to the best of your ability to become a successful individual."
- "I thought that it gave a lot of tools to put in my tool belt for my future. Especially learning more about vocational trades."
- "It was really helpful because I didn't know what I wanted to do in life it helped with giving me an idea."
- "That it was very helpful and taught me new skills to help me out with the outside world and job preferences."
- "The volunteers were very engaged, I really enjoyed the mock interview as well."
- "This is an excellent course to learn. I love it very much. It provided about informatics technique, ways to solve computer programs and to build webpages with basic code steps. It was an awesome course to me."

PEP-DJJ results in an extraordinary learning and hopeful experience for the staff, PEP instructors, and in-custody students. Altogether, PEP's College Readiness Program brought four core modules that allowed youth the dynamics of being a well-rounded student such as: "Introduction to College", "Introduction to Soft Skills", "Career Development", and "Financial Literacy". Through a program evaluation survey that was distributed, it contained five questions on a Likert-scale about the program, their opinions, and how the courses would help them.

The "Introduction to College" data was on a scale of strongly agreed to strongly disagreed. The survey for the "Introduction to College" post-course survey contained opinionated and open-ended jurisdictions such as: "This course inspired me to go to college", "I learned how to apply to college in this course", "I learned what my academic interests are in this course", "I learned successfully study techniques in this course", and "This course will help me become successful when I discharge". The results concluded between 14-18 individuals choosing strongly agreeing and agreeing for each of the following. Moreover, an average of 5-6 individuals chose neutral and its lowest at 2. The only negative response was 1 disagree in the "This course inspired me to go to college" section. This data was sampled among a total of 37 males and females from the Ventura Youth Correctional Facility, N.A. Chaderjian Youth Correctional Facility, and O.H. Close Youth Correctional Facility. Granted, this course received more positive feedback than negative and it is also reflected in the post-course comments. Majority of the post-course comments found that this course was extremely helpful and helped them gain more knowledge about college.

In a similar fashion, the "Introduction to Financial Literacy" post-course survey contained opinionated and open-ended jurisdictions such as: "I know about various money management strategies", "I know the process of buying a car", "I know the process of getting an apartment", "I know the concept of credit", and "I know various ways to pay for college". Likewise to "The Introduction to College" post-course survey, the results concluded between 1527 individuals choosing strongly agreeing and agreeing for each of the following. Then, around 6-10 individuals chose neutral. Any negative response occurred in the "I know the concept of credit" and "I know various ways to pay for college" section, 3 individuals selected disagree and strongly disagree. An adjustment can be made to resolve any lacking information this course had in these areas. This data was sampled among a total of 52 males and females from the Ventura Youth Correctional Facility, N.A. Chaderjian Youth Correctional Facility, and O.H. Close Youth Correctional Facility. Accordingly, this course received mostly positive feedback with little negative feedback. It is also shown in the post-course comments. Many of the individuals commented that the course assisted in understanding the process of buying a car, paying for college, and taught them how to save.

The "Career Development Course" post-course survey asked 3 yes or no questions pertaining to the impact of the course: "Did this course increase your interest in the subject matter?","Did this course inspire you to further your education?", and "Will you be able to use the information that you learned in this course when you parolled?". All questions received a yes and showed a clear benefit to the individuals from this course. The data illustrates the responses from males at the Ventura Youth Correctional Facility. The sample size taken from a setting of only one class. Given these points, the male individuals

expressed their overall thoughts on the "Career Development" course. Several of the post-course comments mentioned helping in having an idea of what careers are available to them and using your resources to the best of your ability to become a successful individual.

The reconstruction of the juvenile justice system should be kept in review and consistently reevaluating finer methods. The progressive changes in the system and PEP courses are a reflection of these progressive changes. The school-to-prison pipeline has always been an extensive concern. There is a strong relationship between educational attainment and youth's outcome. The PEP is equal to reversing the "school-to-prison pipeline" and halting the non-developing improvement in supporting youth. PEP's College Readiness Program has recognized the poor outcomes and the need for a greater crossover system between school and prison to correct negative outcomes for youth.

It is clear that exposing the DJJ students to the PEP courses has provided quality education and social skills that are imperative to mold them into productive and functioning adults. These courses bring knowledgeable material that will assist them in the future with significant educational opportunities and breaks down restrictive life-long barriers. PEP courses in the past also have demonstrated to be beneficial and received positive feedback because it reduced behavioral misconduct in facilities. Taken from the results of the program's impact from the perspective of the youth, the program's framework and methods can be reconstructed favorably with comprehensive understanding. PEP then can continue to integrate offender responsibility, a reduction in criminal behavior, resiliency, and restorative justice principles. To emphasize, education and the juvenile justice system require improving services that benefit youth with no limitation.

Methodology

Qualitative data is used to discover the impact of the program and participant observation is the basis. It is designed in a manner that reveals the behavior of incarcerated youth with the opportunity of becoming a well-rounded student and productive citizen in society in the future. PEP's College Readiness Program brought four core modules that allowed incarcerated youth the dynamics of being a well-rounded student such as: "Introduction to College", "Introduction to Soft Skills", "Career Development", and "Financial Literacy". Two courses per semester (Spring, Summer, and Fall) will take place at each facility and each course will be 90-minutes in duration offered once per week. The program lasts for a span of 7 weeks. There are approximately 18 individuals within each class. Together with the assistance of university student volunteers from 4 universities, PEP provided Study Circles programming in the three Division of Juvenile Justice (DJJ) facilities: Ventura Youth Correctional Facility, N.A. Chaderjian Youth Correctional Facility, and the O.H. Close Youth Correctional Facility. Student volunteers were each interviewed from 4 universities within proximity of these facilities. Namely, university student volunteers with interest on PEP were chosen from University of the Pacific, California State University Stanislaus, and University of California Davis. Henceforth, 10 students were recruited for each course with 1 session leader and 9 volunteers; each assigned a mentee. PEP courses in the past have demonstrated to be beneficial because it reduced behavioral misconduct in facilities. This program has been supported by the following foundations in the past: California Wellness Foundation, the Liberty Hill Foundation, and the California Community Foundation.

A program evaluation survey is distributed that contains five questions on a Likert-scale about the impact the program held and how the courses would help them. The youth participants will then describe their experiences and whether the modules were impactful after the program. Notably, the program evaluation survey is done blindly and kept anonymous. This method is used not only about "what" the individuals rawly think but also "why" they think so. The results of qualitative methods are more descriptive and can be inferenced. At the end of each year-long cycle, focus groups were also hosted. Focus groups with the youth who took part in the program to discuss the influence and impression that it brought for them. Additionally, captains, correctional officers, correctional counselors, and the reentry coordinator were evaluated in a focus group. The volunteers in the program were required to submit a 3-sentence "Session Report" electronically to the PEP administration after each session. If any conflict occurred, this internal assessment mechanism granted constructive criticisms to make real time modifications in any particular course. Volunteers were also required to give their overall assessments on their experiences at the end of each semester.

Given these substantive information, this benefitted the program on what worked and what did not work. Proper adjustments can later be made with appropriate content and resources in future courses. By evaluating the program's impact and abilities from the perspective of the youth, facility staff, and the university volunteer students, the program's framework and methods can be reconstructed favorably with comprehensive understanding. Choosing the qualitative approach, there is the focus on the events that transpire and the given outcomes of the program from those involved. This methodology concentrates on the next helpful step to decide and take forward as a frame for the program. To summarize, obtaining results through surveys, assessments, and focus groups would help build an efficient model describing how individual-, contextual-, and teacher-related components impacts an incarcerated youth's preference for learning in PEP's College Readiness Program.

Conclusion

All things considered, advancing the system to further prevent youth's mistakes from barriers that prohibit life opportunities and reintegrate them into society is the prime goal of juvenile justice reform. A more effective, rational, and humane system takes time and investment with no simple shortcuts. Juvenile justice focuses on inflicting punishment for their crime instead of developmental mechanisms that are instrumental in prevention of youth crime at an early stage. Even with the developing direction that California has made toward juvenile justice reform, it's important to realize that the "discipline gap" and criminalization of black youth is as wide as ever with no significant change over the years. The lessening number for incarceration of youth should apply to all affected. As there is a focus on numbers for the progression of juvenile justice reform in California, quantitative data is used to discover and present any prevalent trends and patterns within the incarceration of youth. The criminalization of youth of color and disproportionate minority contact (DMC) in schools contribute to these prejudices. For this reason, it has been acknowledged that this excessive criminalization of youth and DMC in school can directly lead to the involvement of the juvenile justice system. It can be seen that the structure and framework of the U.S. juvenile justice system is built upon prejudices. Comparative data,

articles, and research evidence reveal unending racism. In the same way, the capture of prominent fighting and unfortunate casualties continue to stand out. The progression of juvenile justice reform in California still calls for greater assembly build.

There is a clear correlation between the education system and juvenile justice system in a youth's outcome. The education and juvenile justice system are in need of improving and ever changing services that benefit youth with no limitation. There are programs that significantly aid and assist in this matter in California such as mentioned, The Prison Education Project (PEP). With the help of PEP's new College Readiness Program, the DJJ-to-college pipeline will come into action as time goes on and youth will be inclined to greater life opportunities. The work that PEP has done over the past years is astounding and could be taken as an example. Moreover, PEP courses have proven to be a reflection of educational progressive changes in the juvenile justice system. Through the College Readiness Program, the collection of data allows for close observation and comprehensive understanding. If any conflict occurred or modifications were to be made, constructive criticisms from data and past program experiences to make real time changes in any segment of the program can be done.

Further Research and Programs. In hope that beneficial changes like this can continue, The Prison Education Project (PEP) is not the only supporting program needed to continue to transform the juvenile justice system in California. California is in the phase of transitioning out the Division of Juvenile Justice, creating another opportunity for substantial reform. For the transition to go forward, health-based community services to address the needs of young people is crucial. The implementation of restorative practices rather than punitive punishments is the better solution in situations for youth. By continuing to follow out the PEP's framework and goals, the juvenile justice system can have better and beneficial alternatives. A recent overview of youth's justice in California has been reimagined to a system that prioritizes equity and accountability. It recognizes the needed healing-informed feedback and grants a coordination to grow and spread development in youth justice. Similar and some other types of projects include National Center for Youth Law (NYCL), Court's Community Justice Conference (CJC), etc. NYCL's objective is to contribute to transforming California's juvenile justice system to ensure youth are treated in an appropriate manner by eliminating prosecution and prioritizing developmental and restorative work. Similar to PEP, CJC is working to provide a structured, nine-week program that is recognized and uses a data-based, early intervention design. This program will also work with trained mediators to support first-time juvenile offenders understand their consequences and provide restoration with skills-building and empowerment strategies to develop restitution plans.

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Tavasol   **Team Cut the Bias Final Report**
Marmar
Project Summary

Cut the Bias is a project meant to bridge the gap between academia and the community through (1) community education, and (2) creative outlets such as performance arts. The project features events with presentations by experts on topics of race, prejudice, implicit biases, and other current social issues, as well as musical performances and other forms of art to create a comfortable space for learning and connecting. The project is aimed at both students and community members who wish to learn about and discover different ways they are affected by systemic issues. Moreover, by providing a venue outside of a college campus that allows for open discussion, we aim to engage with people who have historically been denied access to higher education. Another way that the team is organizing community education is through online reading groups with free reading materials through GroupMe and Zoom. We discuss topics themed around the empowerment of oppressed populations with a diverse group of people. Through these projects, we find innovative ways to use the resources given to us as college students to have direct application in communities that need it the most. Despite the challenges we have faced due to COVID 19 and the protests, we are finding ways to use our privilege in education for public service.

Introduction

Cut the Bias is a project meant to bridge the gap between academia and the community through (1) community education, and (2) creative outlets such as performance arts. The project features events with presentations by experts on the topics of race, prejudice, implicit biases, etc., as well as musical performances and other forms of art to create a comfortable space for learning and connecting. The project is aimed at both students and community members who wish to learn about and discover different ways they are affected by systemic issues. Moreover, by providing a venue outside of a college campus that allows for open discussion, we aim to engage with people who have historically been denied access to higher education. Another way that the team is organizing community education is through online reading groups with free reading materials through GroupMe and Zoom. We discuss topics themed around the empowerment of oppressed populations with a diverse group of people. Through these projects, we find innovative ways to use the resources given to us as college students to have direct application in communities that need it the most. Despite the challenges we have faced due to COVID 19 and the protests, we are finding ways to use our privilege in education for public service.

Customer Discovery Summary: Our customer discovery interviews after the first event gave us different insights on what can be done to improve the experience and the project. One of the themes throughout the interviews was that the presentations were not long or detailed enough, which was a concern prior to the event as well. We had decided to not run over an hour, in order to keep the audience engaged. However, we were surprised to find that the audience would have liked a longer set for the presentations. In order to solve this, we will incorporate longer presentations during the event, as well as other resources, such as the online reading group and other materials available to take away. Another point of improvement was the timing of the event. The event was set-up to be during the nighttime, however, many of the audience members would have appreciated it starting earlier, in order to accommodate kids and the elderly. Knowing now that the event is reaching wider audiences and a broader age range, we can adjust small changes that will make it more accessible. The customer reviews really appreciated having this event be in a venue that is accessible to the community, and having professors and other experts come in to educate the population. The creative aspects of the event also helped keep our target audience interested in the materials.

After the pandemic, we conducted a separate customer discovery with 5 participants, which included philosophy students from CPP and Cal State Fullerton, a law student, a community college student, and a paralegal. We asked them how they see themselves being engaged with political theory that has real-world relevance. We also found that having a study or reading group only for the summer motivated people to participate, since most were students and were not attending classes during the summer.

From those discussions, we gathered that just distributing academic resources is not enough to promote engagement, and we need interactive tools. So, we came up with having a GroupMe group for virtual discussions, as well as hourly weekly zoom meetings. The rationale behind this was that even if people from different time zones, with different schedules, etc. could not meet during the zoom call, the readings could still be discussed over the online group.

Methods

The goals of this project are to give resources to the community in order to educate them about the different forms of systemic injustice that are affecting them, as well as provide a space for them to have discussions and explore such themes. In order to achieve this, we come up with different spaces that will provide people with a comfortable environment to have these discussions. Initially, this was an annual event with (1) field experts giving presentations and hosting discussions about the aforementioned themes, and, (2) art, performances, VR demonstrations, etc. to engage with people in creative ways. Having another event was our initial goal, but due to difficulties with COVID 19, the event has been pushed back, and we changed the milestone to be the weekly reading group hosted over zoom. In this group, discussed themes around the empowerment of the oppressed in order to learn about the history of revolution, reform, and resistance. Further, we connected the themes of the readings to current events and ask questions about how we can better create conditions of justice. The beginning was the first event, the middle milestone was the planning of the event and having speakers, performers, artists, and other demonstrations contracted. The third milestone was planned to be the actual event, however, due to COVID 19 and having to push back the event, will be the online reading group. The reading group ran throughout the summer, and featured guest speakers. The reading group was being promoted online through instagram (@CutTheBias), as well as by email to CPP students. We have collaborated with California State University, Fullerton's philosophy club as well as some Pomona School District teachers in order to widen our audience.

Assessment

Assessment: The goal of Cut the Bias is to provide community members with different resources to be educated about oppressive systems, as well as give them tools to empower themselves. We are focusing on the Pomona area and East Los Angeles communities, without focusing heavily on the type of target audience, since we hope to reach a diverse set of people. We hope to do this because we believe that education is a primary tool for the project of liberation, and that formal education and academia do not do enough to provide access to education and resources for underprivileged populations.

We will measure the progress of this project by seeing their progress in the reading groups. Moreover, reaching a wider audience who actively participate is taken to be a positive measure of our success. We look at other reading groups and events for guidance, but have formed this group based on the needs and desires of the community we serve. Currently, we have 10-15 participants who have been actively present weekly. Although the event has a much wider audience, the reading group requires persistence as well as more work per individual participant; so, having a smaller group is not a failure. We adjust the types of readings, amount, and the medium of communication based on our target audience in order to achieve better results. Moreover, we have diversified the team of the reading group to include teachers and experts in economics, history, and business in order to better achieve our results of empowering people through education. The current events regarding George Floyd's murder and nationwide protests have created an even more urgent need for this project, and we are hoping that we will meet the needs of the community.

Results

At the end of our reading group, we conducted an anonymous survey for all of the reading group participants, as well as an open discussion forum on GroupMe to discuss the reading group and the participants' experience. Because of our limited resources and having to change the project's structure, we did not have the resources to get an IRB approved study. However, from the reading group, we had a total of 42 members on the GroupMe virtual group, with an average of 10-15 participants on the weekly zoom meetings. 26 members took the anonymous survey, and out of the 26, 17 reported that they tried to keep up with the weekly readings and discussions, 12 found it educational and meaningful, 17 said they were inspired to take on political and social action, and 3 reported not having gotten what they hoped for out of the meetings. Given the constraints of the pandemic, the results of the project are positive, and show that despite such trying times, there are still ways of being impactful in our communities.

Milestones

Milestone 1: Completing event planning details, including booking venue, contracts with artists, vendors, etc. Having a list of tasks to be completed, and delegating tasks to the volunteer team

Due to the COVID 19 pandemic, the middle and last milestone have been modified..
Milestone 2: The second milestone will be closing out any possible contracts that were tied to the physical event, and setting up virtual substitutes. We decided to have a summer

reading group that covers historical issues that may be relevant to the current socio-political climate. The list of readings that were covered were chosen by looking at what is typically covered in academic classes, and deciding to find material from the outskirts of the typical cannon. After the list of materials was decided, we found ways to connect with the CPP campus as well as the wider community. We had a GroupMe group chat to discuss readings and the logistics of the meetings, and used zoom on a weekly basis throughout the summer. Milestone 3: The third milestone is completing the summer reading group, reflection, and incorporating feedback for future groups.

Milestones
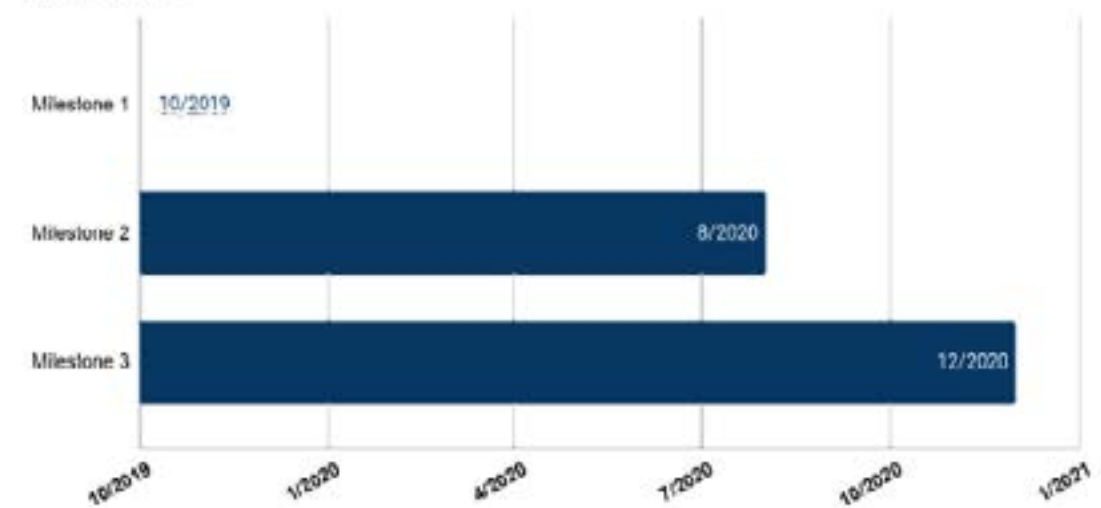
Conclusion

Initially, the goal of this project was to put on an event with over 500 attendees, live performances, and different interactive and educational tools to combat prejudice and implicit biases. This became impossible to carry out once the COVID 19 global pandemic hit. So, we decided to compromise and have a more focused group of people who study different historical texts that focus on empowering oppressed people over the summer. The goal of this project was to continue on having a critical lens, even through such chaotic times, and we think that the project succeeded in this. There are different ways to carry out this project with different audiences, and we hope to continue on having annual reading groups. Being virtual gave us the opportunity to have participants from different parts of the country participate in our group, so we might continue to keep the online format.

Tuitavake   **Internal Migration Caused By Climate Change**
Lupe
Abstract

Internal migration caused from climate change-induced natural disasters is a phenomenon that the state of Florida experiences, specifically between the city of Miami's low-lying coastal properties and the higher ground, inland community of Little Haiti. Internal or climate migration is caused by climate change and happens when people lose their homes due to natural disasters and become temporarily or permanently displaced, which more than two million coastal residents from Miami are predicted to be by 2100. People tend to move to familiar places after loss of their homes whether through living with other kin, other social connections or more local job opportunities. This is a pattern in Miami with news of Little Haiti negatively affected by the rise in demand of their safer, more inland properties. Such internal migration from affected coastal areas can create issues such as overcrowding or climate gentrification, which refers to the process of higher-income and white populations who move to locations that are safer from natural disasters where mostly low-income, communities of color originally lived. As Miami is the leading city in rising sea levels and climate migration, the city is unprepared to tackle such issues because they lack the proper policies and have no current action plans addressing it. Thus, the purpose of this research is to investigate the best climate adaptation and return/settlement policies through analysis of examples practiced in the state of Louisiana and its' Louisiana Strategic Adaptations for Future Environments Plan and the state of Alaska and its' Alaska Climate Change Impact Migration Program. These states and their actions towards climate adaptation and return/settlement policies are relevant choices for Miami because they share similar budgets for climate change effects and share similarities in geographics with coastal areas affected by climate change-induced natural disasters. Both states currently implement actions that help their populations prepare for future disasters and protect current low-income communities from their effects. From the Louisiana case, the city of Miami can incorporate housing incentive programs to encourage diverse housing development in higher ground areas for affected coastal residents but be built away from already occupied cities such as Little Haiti. More investment for the residents and businesses of Little Haiti should be considered to help strengthen their economic and political infrastructure too. In an extreme case where relocation may be a possible option in the case that Miami's coastal neighborhoods are declared uninhabitable, Alaska's example of relocation with a grant provided to help build housing and other infrastructure can be a useful guidance. Miami should consider these options and create more resiliency policies and programs that protect not only their physical infrastructure but also their marginalized, economically vulnerable populations who become displaced in the after-effects of such disasters.

Introduction

Climate change-induced migration will become more of a reality in the near future on a national and international level for many countries (Martin, 2012). In the past 10 years, coastal communities in the US that relocated due to flooding, erosion or rising sea levels are evidence that migration due to climate change, whether within the local area or outside of a city or state's borders, will be a more frequent and pressing issue that city governments, decision makers and planners have to address (Bettini, 2017). Individuals and communities living in these affected coastal areas of the US will be forced to move inland after losing their properties to such environmental disasters, which will intensify any overcrowding, housing crisis, and other urban issues that the receiving city may experience. Yet there is lack of development in the migration, return and settlement policies pertaining to climate change (Ebrahimi, 2019).

In Miami, Florida, more residents experienced displacement each year due to climate change particularly residents of color who live in higher ground and poorer communities (Harris, 2018). Miami is predicted to reach anywhere between fourteen to thirty-four inches of sea level rise by 2060 (Sea Level Rise Work Group, 2015). As more shoreline properties grow to be a higher risk of residence, developers seek after the real estate in those neighboring high elevation areas, which pose a threat to its residents. On the other end of this situation in Miami, those whose homes were destroyed or are threatened by the impacts of water related disasters can become temporarily or permanently homeless or move inland where enough new movers can cause gentrification (Harris, 2018). This form of movement between these two groups of residents, those of inland and those in low-lying seashore areas is an issue of internal migration. Currently, Miami's extent of solving the problem is disaster relief and the recent start of research on how climate change will affect its real estate and development. However, the city's disaster relief plan mostly entails temporary housing solutions and adjustments while Harris (2018) says the research has no confirmed plan or timeframe on how it will be directed or whether it will specifically discuss solutions or preventions to internal migration. If there are no concrete solutions or policies to enact for the coastal community of Miami and its residents, then internal migration will affect the greater surroundings with other communities and individuals.

The focus of this study will be on the internal migration within the city of Miami, Florida, the leading US city in rising sea level and water-related disasters and displacement. The study will focus between the neighborhoods by the shores and those that are in higher elevation above sea level and further away from the coast. Using case studies in Louisiana and Alaska where migration was successfully addressed and interviews with officials from their more disaster vulnerable towns, I investigate what can be the best policies for climate adaptation and return/settlement for affected Miami communities. In this study, I outline the current lack of policies and plans addressing climate change-induced migration in Miami by research and exploration of the city's most recent general plan, climate change plan and disaster relief plan. I aim to provide a set of policies and decisions for climate change related migrations for the city.

Literature Review

Climate change is a global phenomenon that affects every country and place on this earth so powerfully and in variously different ways. Heat waves and wildfires burned roughly 6.9 million acres of land in California each year since 2000 (US Congress, 2020), 2.7 trillion tons of ice from Antarctica raised the global sea level by one centimeter in the past five years (Meyer, 2018) and a reported 500,000 detectable earthquakes happen every year (U.S. Geological Survey, 2020) around the world. The rate at which these natural disasters and others are happening is significantly increased due to climate change and global warming. Every year, these occurrences happen more frequently than the last and at more

intense levels, which present themselves as great threats to human life, increasing casualties, destroying livelihoods and devastating economies.

Aside from rising sea levels, other water related disasters caused from climate change include coastal erosions, floods, hurricanes, monsoons, tsunamis and landslides. In the past thirty years, this mix of weather and climate disasters left the United States with billions of dollars in repair costs and no power for long periods of time. Over thirty severe flash floods occurred between 1980 - 2019 in the US and left an average of $4.6 billion worth of damages each. About one hundred thirteen severe storms and forty-four tropical cyclones happened within the same period and cost $2.2 billion and $21.5 billion respectively in repairs and took thousands of lives every time. These natural disasters especially affected the communities and people that live near coastlines. States such as North Carolina, Florida, and Louisiana are experiencing record levels of those high floods, storms and coastal erosion which leave their affected cities in frequent devastation and reconstruction each year (National Oceanic and Atmospheric Administration, 2019).

Miami, Florida ranks as the top city in the United States that experiences the worst water-related disasters coupled with the after-effects of physical displacement, gentrification and economic loss. For several years, the city experienced and continues to experience coastal erosion, floods and loss of land due to rising sea levels (Harris, 2018). The present threats are so clear that most houses near the beach or coast are losing their values quick. New research suggests that houses in lower elevations are pricing much less and increasing in value slower than properties of similar traits in higher ground areas, which assumes that developers and home buyers are considering potential climate change disasters as a main component in their decision making and investments. When Hurricane Irma hit Miami in 2017, there were billions of dollars in damage repairs towards the coastal beach properties, which turned low-income and minority communities like Little Haiti and Liberty City into highly demanded real estate because they are farther away from the coast, higher elevated and more protected from extreme weather. Wealthy buyers are now looking to these more naturally protected areas and are convincing developers and landowners to raise their costs or buyout residents (Nathan, 2019).

But the case of gentrification caused by climate change is not the only issue that is concerning Miami in terms of water-related disasters. Each year, millions of people are displaced by these disasters and in just the United States, about thirteen million people are predicted to be displaced from their coastal houses by 2100 (Rigaud et al, 2018). That is when the issue of internal migration arises. It is a phenomenon that is becoming a more pressing problem each year in coastal states.

Internal migration due to climate change happens when people lose their homes to natural disasters and become temporarily or permanently displaced, forcing them to find shelter in more inland areas. Sometimes, those new places become their permanent areas of residence where they reestablish their roots. Other times, people perpetually end up moving from place to place because they lack the resources and support to help them readjust. Although the circumstances vary between people, the common thread among most cities and states that experience this migration within their borders is that they do not have solid and thorough plans to help these displaced residents find homes again.

A new study on migration patterns used a computer model program that pairs migration data from Hurricane Katrina and Rita with climate change projections from expected sea level rise. The result is an approximate prediction of where coastal populations will migrate when they are forced to leave due to climate and weather disasters. The prediction also includes the catalyst effect that it will have on the migration of non-coastal residents (Robinson, 2020).

By 2100, the model predicts that almost all areas and counties along the East and West coast of the country will be gone into the ocean due to the six-foot rise in sea level. And based on past migration patterns from the IRS data used in the study, the predictions show that climate migrants will most likely not move extremely far away but will adjust to changing conditions in already overwhelmed areas, meaning affected coastal residents will move to adjacent neighborhoods or counties (Robinson, 2020). Hauer, a demographer who has extensive research on climate migration, stated that people tend to move to places that are familiar whether they have close kin or other social connections or more opportunities to readjust without having to move far, like moving to the bigger cities which also tend to be more inland (Poon, 2020).

One example is in Dallas and Houston where coastal residents along the Texas border moved after Hurricane Katrina in 2005. Immediately after the storm, Houston received as many as 250, 000 people from the state's affected coastal areas including some migrants from Louisiana. A year later, about 150,000 were reported to still live there. Roughly 5,000 people who were affected by the hurricane in Louisiana also relocated within their state to cities like New Orleans and Baton Rouge (The Times-Picayune, 2015). This pushed these already dense areas to further urbanize and become impacted in their housing and food resources. Thus, the issue of internal migration not only affects coastal communities negatively but the inland and higher ground areas too as they will continue to experience large social, economic, physical and political impacts from the sudden increase in new residents.

Of those thirteen million coastal residents predicted to become displaced by 2100, more than two million of those people will be from Miami. The city is expected to be the number one city in the US to lose the most residents from rising sea levels (Iannelli, 2017). The level of migration happening now within the state of Florida is mostly concentrated around the city of Miami between the coastal areas and the enclave neighborhoods that surround it. Little Haiti is a cultural enclave of Haitian and Caribbean working-class immigrants. Long time residents from the North, Mid and South Beach areas moved to Little Haiti after their homes started to lose values and they became more aware of the predicted climate change disasters to come in the near future. The result is that many of these long-standing Haitian and Caribbean residents are forced to relocate farther away from the city where there's more affordability. Frustrated because they cannot do anything to convince their landowners from uprooting them, they must start anew and make way for wealthier new residents moving from their beachfront homes. This in turn also affects the local small businesses in the neighborhood as tastes in consumerism tend to change too. Haitian business owners lose their long-time customers and their rent increases like the residential properties in the area (Mooney, 2020).

Internal migration is a sort of issue that is becoming an ongoing occurrence in Miami because current disaster relief efforts outlined by the city are only temporary solutions that are meant to provide instant relief and shelter but there is a lack of follow up and long-term support. Currently, there is only a 2015 updated Disaster Relief Plan for those types of immediate efforts. The Regional Climate Action Plan 2.0 is a document that entails prevention methods that can be applied to construction of new development, protection of certain canal entries into larger bodies of water and predictions on future climate change trends and storm surge patterns. Although this document provides regional climate adaptation strategies, not many are currently applied or enacted and there is no specific mention of climate change-induced migration or return/settlement policies.

Methodology

To begin, there must be analysis of the most recent, relevant and up to date strategies and information relating to climate adaptation and intended steps after climate change disasters for the city of Miami and Little Haiti. Thus, the documents chosen to be analyzed are the Resilient 305 Strategy Plan (R3S), the Regional Climate Action Plan 2.0 and the 2015 Disaster Relief Plan. However, they also serve the purpose of revealing that there is a gap in planning for return/settlement policies when populations within Miami move and cause climate gentrification and displacement between differing communities, or at the least, these documents do not explain or address that issue directly.

In relation to Miami, Florida, two case studies in Louisiana and Alaska were chosen to further analyze the effects of climate-induced migration and their respective combat efforts through climate adaptation and migration policies. The first is the set of six parishes surrounding New Orleans in Louisiana (parishes are analogous to counties in other states). The second is Shishmaref Village in Alaska. Both places experience their own set of environmental changes but are similar to Miami in their experiences in climate change induced internal migration where their coastal residents forcibly moved to more inland or safer locations (within their state) because their homes were either destroyed or are threatened by natural disasters. The Louisiana parishes and Shishmaref policies and plans on settlement and climate adaptation are in full practice with outlined procedures and existing data about the people affected.

Some population demographics and physical environment of each of the two locations and Miami are included for a more holistic understanding of their similarities and differences, which is a component to consider when trying to understand how suitable Louisiana and Alaska's climate change documents can be for Miami. Further research from interviews and documents will include the indicators of how successful these policies and plans of these two locations have been in terms of intervention and results.

Case Study in Shishmaref Village, Alaska

Shishmaref Village in Alaska has about 600 Indigenous Inupiat residents. The village is located by the Chukchi Sea where ice is the natural barrier to the ocean, but over many years, it has lost about four feet of shore land each year due to natural erosion and continues to be accelerated due to climate change. In 2003, the Government Accountability

Office reported that most of Alaska's native villages were directly affected at some level of water related disasters, mainly flooding and coastal erosion. The U.S. Army Corps of Engineers' 2009 Alaska Baseline Erosion Assessment lists Shishmaref and these other Alaskan villages that are affected along with their relocation options. In 2016, between two options, the majority of the village agreed to relocate to the main island of Nome if another disaster strikes that will cause severe damages to their building infrastructure. For a simple overview of the state's relocation procedure, if a natural disaster were to occur, the state will issue an evacuation and decide whether the residents may be able to return to Shishmaref depending on the severity of damage. If it is not possible, they may permanently stay in their chosen location Nome with provided housing and forced co-location. Some villagers made the move already to Nome in the past couple of years (Herrmann, 2019).

Further data to be collected is on the type of land or housing provided for those displaced, further details on the evacuation process, the economic and urban impact of this influx of new residents in the city of Nome (costs, positive or negative impacts to the current residents vs those coming in from Shishmaref), and what programs or policies exist to help these new residents readjust and integrate into their new surroundings.

Continued research will be conducted through the Alaska Climate Change Impact Mitigation Program (ACCIMP) which outlines technical and financial support for communities affected or threatened by climate-related natural disasters including Shishmaref, which is available on the state's official government website (2020). Other documents include the Shishmaref Strategic Management Plan, Reports and Studies, also provided on the government website.

Case Study in Six Parishes in Louisiana

In Louisiana, the six coastal parishes that have been and continue to be affected by climate change-caused disasters are St. Bernard, St. Charles, St. John the Baptist, Plaquemines, Jefferson, and the Orleans parish. All six are configured around the coastal area of the state and comprise an almost even number of low-income, working class and middle-class people.

The plan in action for these six locations is the Louisiana Strategic Adaptations for Future Environments (LA SAFE), which include predicted flood risks and a recommendation of a series of policy adjustments and updates that can mitigate those flood risks. Some of these suggestions include enhanced transportation routes to manmade elevated houses and shopping centers within the affected areas. The plan focuses on ways that these affected parishes can readjust through these more resilient efforts so that the people, government and businesses can return to normalcy after a natural disaster occurred. The document also includes strategies for how inland areas can prepare for the sharp increase of residents coming from the coastlines (Shankman, 2019). The document further entails policy recommendations for unaffected parishes to adopt include offering more safe, affordable housing and basic social services for those new incoming residents whose homes were lost due to rising sea levels or other climate change-induced disasters. The total budget for the LA SAFE plan estimates at $47 million to start projects in each of these six highly vulnerable parishes (Louisiana Office of Community Development, 2019).

Interviews

Supplementary information for the city of Miami and Little Haiti will be retrieved through phone, email or Zoom interviews with four contacts. The first two individuals are Suzanne Torriente with Miami Beach and Jane Gilbert with the city of Miami (both of whom are resilience officers as part of the Resilient 305 Strategy Plan). The third contact is Uwe Brandes who is director of the URP Program at Georgetown and who spoke on "Preparing Communities to Receive Relocated Residents" in Miami at a Colloquium on Climate Migration in 2018. Lastly, interview request will be to Marleine Bastien, executive director of the Family Action Network Movement (FANM), a grassroots organization with a goal to establish the Little Haiti community on the impacts of climate change and climate gentrification to allow them to make more informed voting decisions when comes time. These interviews will be semi-structured and qualitative with the goal to get more insight on how Miami is operating under current migrations caused from climate change induced disasters and how they plan to combat that along with other pertinent information related to the research.

Supplementary information will also be collected through phone, email or Zoom interviews with Shishmaref and Nome planners (contacted through Lynn Kenealy, Local Government Specialist) and Sally Russel Cox, member of the Division of Community and Regional Affairs and official contact for any information related to the ACCIMP. These interviews will be semi-structured with the purpose of seeking both qualitative and quantitative information. This includes their professional expertise and opinions on current/alternative policies and any information missed or in need of clarification from the listed documents. Also open to discussion are other possible references, documents or points of contact pertaining to migration policies and impact reports.

The last set of interviews will be conducted through phone, email or Zoom interviews with Louisiana parish professionals. Since there are six parishes that are under study for this research, a contact from any or all of the six parishes will be valued. This includes Pat Forbes, executive director of Louisiana's Office of Community Development, Katrina Williams, Consultant for Coastal Communities for Jefferson and Plaquemines Parish, Sharon Foret with Bayou Interfaith Shared Community Organizing for LaFourche and Terrabonne Parish and other possible authors/officials who were involved in developing the Louisiana Strategic Adaptations for Future Environments (LA SAFE) Plan. Interviews for the Louisiana officials will also be structured similarly to the interviews planned for the Shishmaref contacts. Once thorough analysis of the mentioned documents and interviews are completed, alternative policies or amendments to existing Miami documents will be evaluated based on comparisons between the case studies and Miami's political, economic, and geographical similarities to evaluate the best fits. Continued reference will be made to the documents mentioned for both Louisiana and Shishmaref, Alaska.

Findings

Miami, Florida

To investigate the best policies for climate adaptation and return/settlement for the

city of Miami and Little Haiti, the documents reviewed are the Resilient 305 Strategy Plan (R3S), the Regional Climate Action Plan 2.0 and the 2015 Disaster Relief Plan. These plans provided the most recent, up to date and relevant strategies and information relating to climate adaptation and intended actions after climate change disasters. At the same time, they also reveal that there is a gap in planning for return/settlement policies when populations within Miami move and cause climate gentrification and displacement between differing communities, or at the least, they do not explain or address that issue with much clarity.

Resilient 305 Strategy Plan

The Resilient 305 Strategy Plan is a multijurisdictional resilience initiative focused in South Florida. The plan entails thirteen action items that were formulated by several stakeholders from the city of Miami, other surrounding municipalities, and climate change experts with knowledge on water-related disasters, their financial risks and budgets, and future predictions. Out of all the action items, four are found to be the most pertinent to address one of the goals of this specific research (100 Resilient Cities, 2016), which is to find better climate adaptation policies. They are not found to best address return/settlement. The four action items are listed below as A-D:

A) Action 6: Reduce "Back Bay" Flooding
This action calls for reduction on the "Back Bay" flooding, which is the protection of the areas along Biscayne Bay. The bay is the body of water enclosed between the western line of beaches and islands and to its' east is the greater Miami area within the mainland of the United States (use Image 1 as reference). The action calls for a 1-5-year timeframe to upgrade the water control structures along the major canals that access the bay as storm surge barriers, purchase land within the floodplain and restore natural mangroves and reefs. These improvements are to protect the bay from future storms or floods and thus, the immediate areas surrounding it which include Little Haiti and the coastal lines of Miami.

B) Action 7: Implement sea level rise strategy
The sea level rise strategy is projected to take anywhere between 1-5 years to complete. It includes an analysis on the financial costs of inaction and alternative pathways, identification of short-term capital projects on flooding resilience that can be applied by 2022 and an outline of risks that communities will face in terms of sea level rise conditions predicted for the future. The recommendations that are yet to be published will be a benefit to local governments in particular who can utilize the strategy to address these certain water-related issues in their communities.
C) Action 8: Develop sea level rise checklist for capital projects
Action 8 is in conjunction with Action 7. This checklist is created for new infrastructure projects to ensure they are designed with protective measures against floods and storms. The R3S document mentions that the cost of investment to incorporate these protective measures into the design of new buildings is much less than paying for infrastructure/asset loss and/or the rebuild or modification of deteriorating infrastructure. The sea level rise checklist can ensure new development such as housing and businesses can be more resilient in the face of climate change-induced disasters and potentially reduce the likelihood of populations from relocating.

D) Action 11: Maximize opportunity zones

According to the highlighted areas in blue on the SMART Plan Mobility Corridors Map (Image 1) from the R3S document, these are opportunity zones or federally designated areas in Miami-Dade County that are economically distressed communities in need of revitalization through the use of private investments (100 Resilient Cities, 2016). Local organizations and government must come together to develop holistic strategies and actions to allow investments and make sure resiliency efforts are underway. The R3S document includes other suggestions including to increase the outcome of anticipated investments and prevent any unplanned negative consequences in the local communities (100 Resilient Cities, 2016)

Image 1 (RS3, 2016)
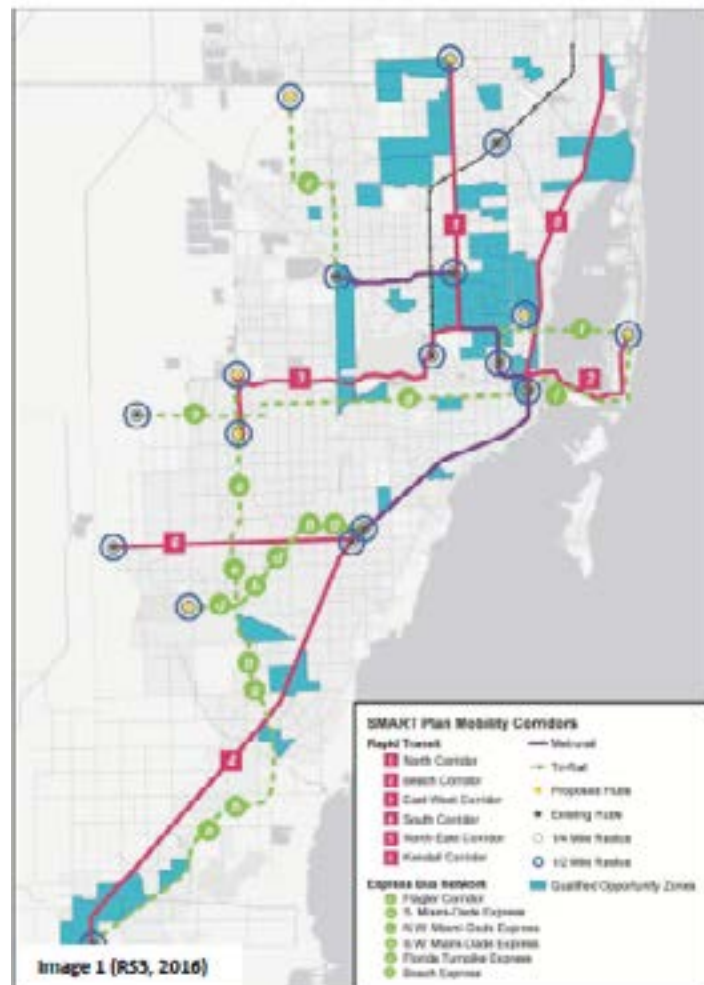
Jane Gilbert works with the city of Miami and is a Resilience Officer as part of the team who created Resilient 305 Strategy Plan. In a qualitative interview conducted with her through email, she expressed that the opportunity zones highlighted in the SMART Plan Mobility Corridors Map include Little Haiti and are a part of the immediate action to improve the cultural enclave's local economy by issue of grants to improve local businesses, improve housing quality and improve housing affordability. Immediate action in the R3S document is defined as a timeframe within less than a year. Gilbert also mentioned, as part of the unintentional negative consequences that these opportunity zones claim to want to avoid, gentrification is one of the main focuses with understanding that in past years, Little Haiti has seen an increase in real estate values. But Gilbert can't confirm that they are solely caused by climate change or rising sea levels.

Regional Climate Action Plan 2.0

The most pertinent information in relation to climate adaptation are prevention methods much similar to those entailed in the Resilient 305 Strategy Plan and thus, both documents support each other. In terms of return/settlement, there is nothing substantial on these topics or climate gentrification or displacement.

2015 Disaster Relief Plan

The city of Miami issued the 2015 Disaster Relief Plan as a series of immediate response strategies in the wake of an extreme natural disaster such as a level 3-5 hurricane, storm, flood or tsunami. Two types of evacuation instructions are given. The first is an evacuation recommendation which the mayor of Miami-Dade County suggests for certain residents who may have mobility issues or those who live in areas at risk to flooding that may not be in storm surge inundation areas. The second type is an evacuation order which the mayor will order residents of highly at-risk areas to move based on a storm's track, pace, and projected surge strength. These residents are mostly in neighborhoods near the coastlines along Miami. Areas that these residents should evacuate to are inland in non-evacuation areas (whether they are staying with family or friends who live there or not) and hurricane evacuation centers but the centers are reserved for those who do not have any other option of safe shelter and is therefore considered a last resort (Rollason, 2015). Other instructions after an emergency evacuation order are listed in the Disaster Relief Plan but all locations and recommendations made by the mayor are determined in the few weeks prior to a potential storm.

The evacuation orders are based on zones and residents can utilize the Storm Surge Planning Zone Finder tool under the Miami Disaster Relief Webpage to determine their level of storm risk and evacuation based on their zone (Miami-Dade County, n.d.). Image 2 is a screenshot taken from the Storm Surge Planning Zone Map which shows the area of focus for this research, being the Miami area and Little Haiti included. Of the Disaster Relief Plan and the zone map, the main point taken from them is that Little Haiti is not highlighted as a zone under any level of risk, but Miami is. That detail supports previous findings from this research, which suggests more residents migrate from Miami to Little Haiti and the inland area because of coastline threats to climate change induced storms and risks.
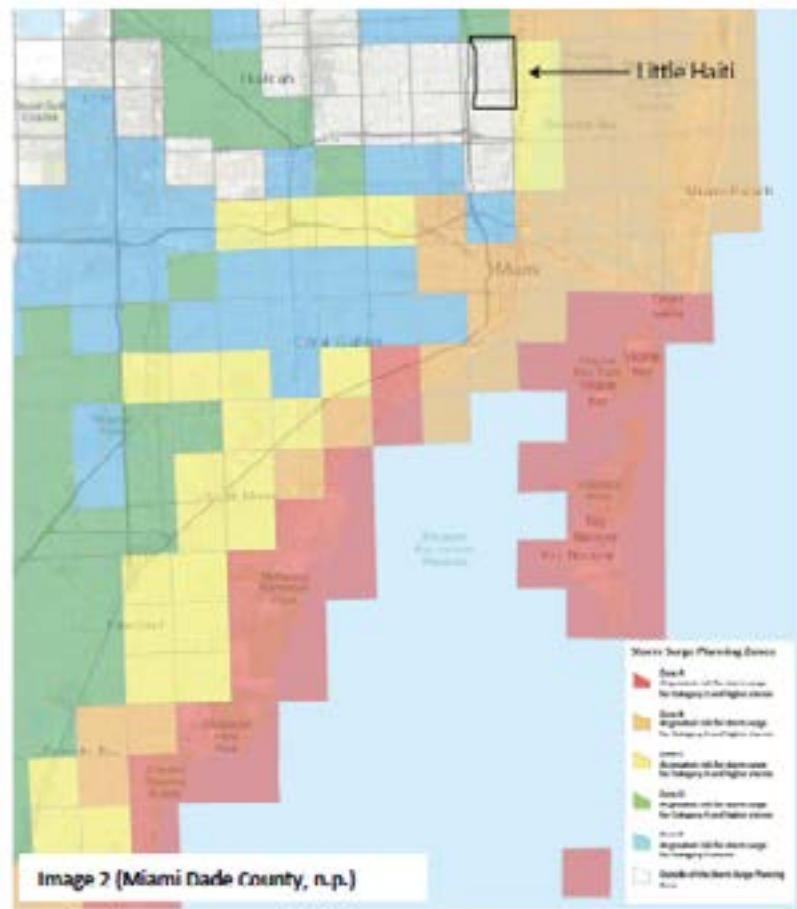
Image 2 (Miami Dade County, n.p.)

The second point taken from the zone map and Disaster Relief Plan is the confirmation that these documents only address temporary relief and nothing long term in terms of climate adaptation and return/settlement, which stress the issue that the city of Miami could benefit from current successful examples of those solutions.

Case Studies

To resolve the lack of information and planning towards return/settlement policies for the city of Miami and their neighboring inland towns such as Little Haiti, two case studies are reviewed because they have current implementation of climate adaptation and efforts in return/settlement for their moving populations caused from climate change. These implementations can be used as suggestions for the city of Miami to adopt. The first case study involves the state of Louisiana's six parishes: Jefferson, LaFourche, Plaquemines, St. John the Baptist, St. Tammany, and Terrabonne. They are highlighted and explained through the 2018 Louisiana Strategic Adaptations for Future Environments (LA SAFE) document. The second case study is Alaska and its' Shishmaref Village, which most of the residents relocated to the capital city of Nome in 2016 after declaration of their original land as unsuitable and unprotectable (Herrmann, 2019). The information for the Alaska case study is explained through the evaluation of the Alaska Climate Change Impact Mitigation Program.

Louisiana Strategic Adaptations for Future Environments

The LA SAFE document lists each of the six parishes, Jefferson, LaFourche, Plaquemines, St. John the Baptist, St. Tammany, and Terrabone, with five strategies. These strategies, provided in Table 1 from the LA SAFE document (see Image 3), are aimed at adaptations that tackle varying levels of flood risk, considerations for managed retreat and specific investment in higher ground receiving communities with low flood risk where people may choose to relocate in response to sea level rise, coastal flooding, and land loss. From all these strategies, the common strategy that each parish plans to implement is to encourage dense, sustainable mixed-use development on higher elevation areas including housing and commercial development. The strategy also ensures to provide diverse and resilient housing stock for all income levels with intentions and steps to create housing incentive programs to encourage these developments in higher ground inland areas (Spidalieri et al., 2020).

Image 3 (Spidalieri et al., 2020)

Alaska Climate Change Impact Mitigation Program

The Shishmaref Village sat on a narrow barrier island on the Chukchi Sea in the western coast of Alaska. The island continually lost land due to erosion and the pace increased over the last hundred years as climate change intensified. In this particular part of the world, icepacks served as the natural buffer between the island and ocean when strong storm surges hit. However, global warming caused the ice and permafrost to melt and the village's land softened and lost around five feet of shoreline each year (Herrmann, 2019).

Image 4 (Georgetown Climate Center, 2011)

Most of the Shishmaref residents agreed in a vote in 2016 to relocate from their narrow barrier island to the inland city of Nome several miles away on the mainland of Alaska. Sally Russel Cox, she suggested to look further into the Alaska Climate Change Impact Mitigation Program (ACCIMP) Process (see Image 4) for a broader understanding of how they process internal migration within the state. The decision to relocate was the first recommendation in the ACCIMP Process given to the Shishmaref Village because of the severity of storm related disasters that hit their island in the past and others that are predicted to happen in the near future. Currently, the relocation of Shishmaref Village is in Phase 2 of the process, in which they were awarded the Community Planning Grant. The grant went towards planning for new community development in Nome in their designated relocation sites (Herrmann, 2019).

Analysis

Resilient 305 Strategy Plan

Although the four action items chosen from the Resilient 305 Strategy Plan (explained in the Findings section) partially explain the city of Miami's plans of climate adaptation and to prevent extreme damages from predicted natural disasters,

they do not answer the question of current internal climate migration and return/settlement efforts or policies. Most of the action items (out of the total thirteen) are prevention methods against flooding and natural disasters, financial cost comparisons between the decision to implement or not, and funding sources. There is not a sufficient amount of information on specific migration patterns between existing communities after a natural disaster strikes Miami or even the broader regions such as any coastal parts of Florida. These action items from the Strategy Plan and the Opportunity zones are not enacted yet and to reiterate, they do not fully address or prepare Miami and Little Haiti for the predicted natural disasters to come and the full social, economic, and political effects that will come with it.

In the interview conducted with Jane Gilbert for information regarding the city of Miami and their steps on climate adaptation and return/settlement, she referred to the Resilient 305 Strategy Plan as a document that helped create the Miami Forever Climate Ready strategy which is an ongoing document that will be updated annually to reach the state's ever changing needs and the changing conditions brought on by climate change (City of Miami, 2020). This Miami Forever Climate Ready strategy is the next document to be further analyzed if the remaining timeframe of this research permits so.

2015 Disaster Relief Plan

Based on the recommendation by the mayor to evacuate to inland areas as part of the evacuation recommendation option (Rollason, 2015), coastline residents such as those who live in Miami can impact those inland smaller communities such as Little Haiti because of the large mass of people who need immediate shelter in their higher elevated neighborhoods. Secondly, the Storm Surge Planning Zone Map is a tool that real estate agents and developers may use to inform their decisions of where to build new housing development or increase prices, which further suggests the potential issue of climate gentrification or displacement.

Louisiana Strategic Adaptations for Future Environments

Most of the strategies listed for each of the six parishes in the LA SAFE document, include actions to help people relocate to these less risky areas with suggestions that parishes provide financial relocation incentives and education programs. This may be a useful strategy for the city of Miami to adopt in order to support their migrating residents from affected coastal areas in Miami.

Also, in a qualitative interview conducted with the Consultant for Coastal Communities for the Jefferson and Plaquemines Parish Katrina Williams, she mentioned that there are current efforts to restrict development in more storm prone areas to only allow fishing and coastal/water based commercial uses and purposes. They do not allow any residential development to be made. This restriction of uses in certain areas such as those in disaster prone places, can be another useful suggestion to the city of Miami if it does not already have such a policy in implementation.

Alaska Climate Change Impact Mitigation Program

More research is to be conducted into what the grant funds from the Phase 2 of the ACCIMP Process can be used for and how the amount is determined and allocated for each case such as for Shishmaref Village.

Policy Recommendations and Implications

The current climate adaptation methods in place in Louisiana and mentioned in its' LA SAFE document include an encouragement of mixed use, dense and sustainable development on higher elevated areas, away from their coastal lines. This includes housing and commercial purposes with assurance to create diverse and resilient housing stock that caters to all income levels and provide housing incentive programs to continue encouraging developers and real estate officials to consider only higher ground areas.

From that example, resiliency and stay-in place strategies should be implemented for Little Haiti similar to what is mentioned in LA SAFE. New diverse, housing development should still be focused on higher ground locations but not affect current Little Haiti residents or negatively impact their neighborhoods or businesses. This needs to be clearly and directly stated in Miami's Resilient 305 Strategy Plan because currently, there is no specific mention of the climate change effects and impacts of low-income communities who are at the forefront of being affected by climate migration with current and new coastal residents choosing to move to inland, low-income neighborhoods. Thus, another effort to include in the R3S document is to direct these current and future coastal migrants to specific new development areas for housing, which Miami partly mentioned in the R3S plan. Little Haiti is part of the city's Opportunity Zone, which means it is expected to have more political, social and economic investment and protection with resiliency efforts and revitalization projects. However, the city should be pushed to ensure they meet their 6 month – 1 year timeline of completing said projects and make sure they are making investments that the residents of Little Haiti can benefit from and not be pushed out due to rising property values caused from those improvements, whatever they may be.

On the financial end of ensuring these climate adaptation and resiliency actions, Miami should also offer grants and incentives to help already affected residents whose homes were destroyed to be able to migrate to higher ground areas, if needed. These sources of funding can be secured from the city of Miami's fiscal year 2019-2020 budget for sustainability works, emergency funds and climate adaptation projects for the future, which can be found in their Proposed Operating Budget document in support of the action items listed in the Resilient 305 Strategy Plan.

According to Marleine Bastein, executive director of the Family Action Network Movement in Little Haiti, more community engagement and outreach is mandatory during the whole process of these new developments and not only partially in the beginning for residents of Little Haiti. Their lives and voices are the ones that are constantly marginalized, not given enough representation in planning processes and whose needs are disregarded whenever a new high-income development or increase in property value is seen in their cultural enclave community. Thus, the need for more engagement and outreach from Little Haiti residents and other similarly low-income and high elevated communities is necessary and a justice that must be continually sought out.

In an extreme case, if and/or when the city of Miami declares its' coastal line uninhabitable or no longer protectable, then they should consider the option of relocation as the Shishmaref Village did so in 2016. The Village moved from their narrow buffer island to the mainland of Alaska in the city of Nome. That buffer island was overtaken by floods and storms that were worse every year, chipping away at the island's natural barriers that protected the village for hundreds of years. Similarly, Miami's North and South Beach are on a buffer island that is separated from the main land's coast by the Biscayne Bay. According to the Miami-Dade County's Storm Surge Planning Zone Map, this buffer island is highlighted in red (on a scale of red to orange, to yellow, to green) as Zone A, meaning it is at the greatest risk for storm surges for Category 1 and higher storms.

Although the city of Miami has its' current Disaster Relief Plan for immediate and temporary actions and its other documents for climate adaptation and prevention/protection methods, it is still predicted to lose six feet of shoreline from sea level rise by the year 2100 and will experience floods, storms and hurricanes with greater intensity in the near future (as illustrated in the Storm Surge Planning Zone Map) because climate change will continue to play as the driving pressure. If the coastal lines of Miami and other areas along there are forced to relocate, they can look to Alaska's example with the Shishmaref Village. All 500 residents of the village unwillingly moved but were supported financially through the ACCIMP Community Planning Grant of $150,000 which they used for site selection research into choosing the right relocation site, in this case it is the city of Nome. Something of this sort can be applied by the city of Miami if relocation becomes a likely option. And if so, low-income and minority communities such as Little Haiti must not be part of the relocation options.

Conclusion

As climate change continues to be the driving and compounding force behind the worsening water related natural disasters along the United States' coastal states, internal migration and climate gentrification will continue to be just one of the many issues that arise from such severely life changing events. Thirteen million coastal residents across the nation are predicted to be displaced by 2100 due to exacerbated weather and climate events. Within the state of Florida, more than two million of them will be from Miami as this city is at the top of all other cities in terms of rising sea levels and water related disasters and displacement. These Florida residents experience displacement each year due to climate change induced disasters that cause mass internal migration between the low-lying city of Miami and the higher ground, small cultural enclave community of Little Haiti.

Both locations experienced this sort of migration within the last ten to fifteen years between their two locations. Some of the population of residents that lived in coastline properties moved to more inland and higher elevated neighborhoods such as Little Haiti, which real estate agents and developers state it is safer and thus, of more value as predictions for future storms and natural disasters deem the lower lying properties by the ocean as risky and a foreseeable loss of financial value. This form of internal migration can intensify any existing urban issues of the entire city as population density shifts and becomes more crowded in inland areas. The current 2015 Disaster Relief Plan for Miami is meant for temporary solutions immediately after a natural disaster strikes and other climate

change impact plans such as the city's Resilient 305 Strategy Plan and Regional Climate Action Plan 2.0 are only at a stage of research, observation and gathering data. There is no concrete, on the ground plan placed yet besides expensive disaster insurance and forms of less supportive and temporary relief. None of the mentioned plans address climate change induced internal migration directly nor do they address any implemented resolution in terms of return/settlement policies or climate adaptation specifically to mitigate such migration or displacement.

Thus, the purpose of this research was to investigate the best policies for climate adaptation and return/settlement for affected Miami communities such as Little Haiti and the city of Miami. The existing documents and conducted interview on climate change and resilience for the city of Miami prove that there is a lack of policy and planning that addresses internal migration and climate gentrification.

Looking into the State of Louisiana's Strategic Adaptations for Future Environments Plan (LA SAFE), the current strategies listed that could be of use to Miami are an implementation of housing incentive programs to encourage dense, sustainable and mixed-use development on more inland higher ground areas and to restrict housing and commercial development along certain parts of the coast that are deemed more risky. The plan also mentioned considerations for managed retreat and specific investment into those chosen higher ground receiving areas where people may choose to relocate, which are in vacant properties and not so much in existing communities that are already inhabited.

Alaska's Climate Change Impact Mitigation Program (ACCIMP) was chosen for a worse-case scenario where the extreme option of relocation may be considered. Miami has a future of worsening weather events and natural disasters that can damage its' buffer island of North and South Beach even with protective and resilient design measures on its waterways and physical buildings. The Shishmaref Village is a successful example of relocation with grant funding in 2016 to secure a site in the inland city of Nome with investment to build new sustainable developments and infrastructure for the village people. The Shishmaref moved within a year after their island was deemed uninhabitable and the government ensured their move within a time span of less than a year. If Miami's buffer island were to experience an unrepairable disaster that its' government would also label as uninhabitable, then the Shishmaref Village study should be taken into valid consideration and be included in Miami's 2015 Disaster Relief Plan as a possible plan for an extreme scenario.

Miami's other next steps to address climate change induced migration and its' effects are to amend their Resilient 305 Strategy Plan to include actions taken by Louisiana for housing incentive programs, directing new development to inland vacant properties, and protection and resiliency investments for low-income minority communities. Also critical is that these communities such as Little Haiti who are threatened by rising property values and new high-class developments, should be part of the planning process from beginning to end because their feedback and opinions matter heavily in what comes next for climate adaptation for the entire city of Miami. Only then along with these other measures outlined in the findings of this research, can the city be one step closer to fully addressing climate change induced migration and its' consequences of climate gentrification, displacement, possible overcrowding and other urban issues.

TIMEFRAME

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Battery as Integrated Structure High Endurance UAV

Abstract

Electrically-powered unmanned aerial vehicles (UAVs) have become increasingly important for military, commercial, and private applications, and there is a need to improve their endurance to extend their mission capabilities. To fulfill these increasing range and flight time requirements, a multi-disciplinary senior project consisting of the aerospace, electrical, computer, mechanical, chemical engineering and chemistry departments has been researching various ways to integrate power generation devices and substitute the aircraft's structure with power storage mechanisms, hence create a "flying battery". This paper discusses the ground and flight testing involved in measuring and gauging the improvement in endurance and efficiency of the baseline aircraft1.

1. Goals for Research

The main goal of this undergraduate research project is to optimize the efficiency and endurance of a radio-controlled, electrically powered propeller UAV through the implementation of power generation and storage devices into the structure of the aircraft, as shown in Figure 1.1. Additionally, the team will investigate the feasibility and integration of various power generation devices where thermal and kinetic energy is locally generated. Such power generating devices include a power generation pod through the use of atmospheric gust, thermoelectric generators, and solar cells to collect energy during the day. The implementation of these methods will be carried out in 5 distinct phases.

The Volantek ASW 28 R/C UAV was chosen for its 98-inch tapered wing to allow the installment of several solar panels and the hollow fuselage was necessary for integrating the power management system and other electronic components. The original wing structure consisted of hollow cylindrical aluminum wing spars.

The original Phase 0 Endurance Flight was conducted in February 2020. This served the purpose of providing baseline data to gauge improvements in endurance and aircraft performance in future test phases. Due to an uncontrolled descent into terrain that resulted from errors in the failsafe in the flight controller, the aircraft's original wings were damaged, necessitating the manufacturing of a new wing for phase 1.

The new Phase 1 (flying 3/21/2020) endurance flight serves to evaluate the aircraft's baseline performance with the addition of a new stronger fiberglass wing structure, a larger rectangular wing, and a power management system added. Phase 2 will fly at the same time as phase 1 and involves gluing on the solar panels to the top of the fiberglass wing and integrating the power management system to charge the aircraft's battery during flight. In addition, the simulated weight of all the other power generation/storage devices will be added in to compare endurance with the baseline aircraft. Phase 3 (flying 4/17/2020) further optimizes flight endurance by replacing the top-half of the wing with laminated solar panels, therefore reducing parasitic weight. Phase 4 (flight date TBD) involves replacing the bottom half of the wing with structural graphene supercapacitors. The wing spars will also be replaced with structural batteries. Similar to Phase 3, the integration of this power storage device would further increase the aircraft's efficiency and performance by replacing the existing structure with usable energy capacity.

2. Methodology

Lab (Ground) Testing

After the selection of the UAV, requirements and mission profiles were derived to simulate the altitudes and flight profiles of the aircraft. Ground testing involved measuring the thrust capabilities at different throttle inputs using a load cell to ensure that thrust requirements were met. A power meter was used for measuring the battery's voltage, current, and power as the UAV's main motor drained power over time to gauge the endurance of the aircraft. The required input from the integrated power generation devices to sustain longer flight than the baseline measurements was also determined.

Vibrational kinetic energy from the wing is converted into electricity by allowing a motor shaft to rotate via a gear coupled to a mounted gear rack, which is mounted inside a "power generation pod". This mechanism is shown in Figure 2.1 and is designed to match the resonant frequency of the wing to maximize its deflection and power output. From ground vibration testing (GVT), it was determined that the mechanism is optimally mounted 30° rotated toward the wingtips.

Atmospheric and/or aeroelastic flutter induces multiple modes of oscillation that are difficult to simulate accurately on the GVT. A gust system in the Cal Poly Pomona low speed wind tunnel will be used to excite aerodynamic wing vibrations to further optimize the orientation of the mechanism and measure its wing vibration dampening capabilities.

Flight Testing

Flight testing is done because added weight from the power storage and generation mechanisms, as well as aerodynamic loads, have an impact on UAV endurance. Every flight replicates identical takeoff, loiter, and landing profiles to accurately compare how much longer the UAV is able to carry out its mission.

Power Management

The power management system (PMSys) includes an Arduino Nano, a buck-boost converter, a relay board, and two balance charger boards, along with all necessary wiring to provide a dual battery switching approach. This PMSys utilizes one battery for charging while the other battery is being balanced-charged. The PMSys has inputs for all types of power inputs, whether they be alternating or direct current.

The current configuration of PMSys requires a minimum of 5.5 Volts and 3.0 Amperes. This amount of power is required simply to charge one of the dual batteries that is not being utilized by the electric propulsion motor at a given time.

Testing the PMSys with the Propulsion System

The schema for charging and managing the input power has been and will continue to be tested to utilize the most efficient algorithm to efficiently charge and discharge the power storage systems. Preliminary study of the battery charging suggests that discharging a battery a small amount and recharging would increase the overall endurance of the UAV. These power storage systems have been tested with lithium polymer batteries and Maxwell supercapacitors.

Structural Solar Cell Upper Wing Skin

The structural properties of the solar cells are utilized to replace the fiberglass upper wing skin to reduce weight. The solar cells were structurally joined by encasing them in a transparent plastic laminate sheet, and then bonding the electrical connections between them with a thin foil metal bus bar between the solar cell edges. This provides tension and compression strength, which was proved through destructive structural testing. Also, C-bar metal stringers are bonded to the solar cells to increase buckling rigidity.

Structural use of Supercapacitors as a Lower Wing Skin

As a collaborative effort with University of Riverside and Chemistry Department, the project team has constructed a variety of substrates, electrolytic gels, and designs to optimize the use of supercapacitors for electrical capacity as well as structural strength. These supercapacitors utilize graphene as an internal element which adds to the structural capability of supercapacitors. Stainless-steel is used as the substrate to replace the lower wing skin while still maximizing the capacitance of the supercapacitors. Through testing and research, it was found that polyvinyl alcohol hydrogel combined with phosphoric acid gave the greatest charge/discharge potential. To separate the electrolyte coated graphene from the substrate layers, Teflon was used because it has a very thin cross-section (which increases capacitance) and it is very durable. A proof of concept testing was performed on the manufactured supercapacitors, which can be seen in Figure 2.2.

Robotics

To increase the efficiency and capabilities of any power storage device, automation of manufacturing was deemed necessary. As a result, the team created a robotic arm and programmed it to automate this process. Using a software called 'YOLO' (You Only Look Once), objects within a given frame can be detected, recognized, and manipulated. When the robotic arm is outfitted with a suction device, the arm can precisely control the stacking procedure of all the elements necessary to create a supercapacitor. For the future, the team is producing a method of distributing precise amounts of electrolytic gel either through modularity in the tooling system within the arm, or through another robotic arm working in tandem.

3. Conclusions

Replacing the current R/C aircraft structure with power generation methods and power storage materials that have structural strength properties similar to, or better than their original parts shows promise to reduce aircraft UAV weight which increases flight endurance. Further research is being conducted to maximize the efficiency of the implemented power systems, and flight tests will soon be conducted to compare the improvements in endurance.

Figures

Figure 1.1 Replace aircraft structure with power storage and power structures to reduce weight and increase flight endurance
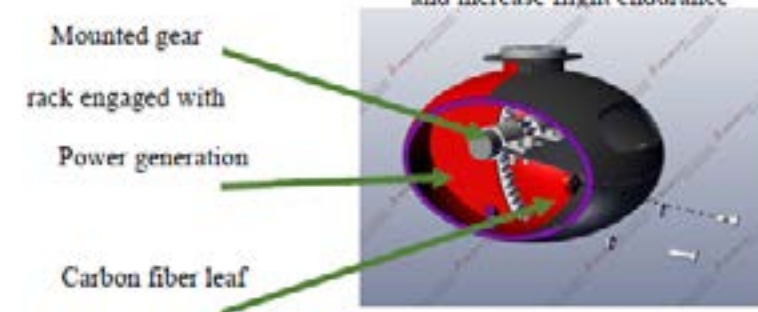

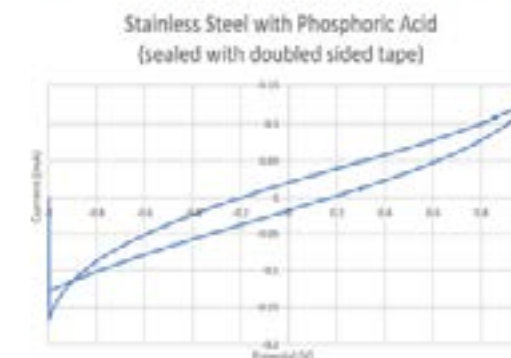Figure 2.1 Cutaway View of Motor-Leaf Spring Mechanism Inside Power Pod

Figure 2.2 Supercapacitor Proof of Concept Testing

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Valerie Tapia

How Mindfulness Meditation Impacts Long-Term Explicit Semantic Memory

Abstract

In light of the Coronavirus-19 Pandemic inflicting the world, college students in the United State of America are concerned about their health, the state of the economy, and dramatic lifestyle shifts, and they are experiencing an increased level of stress (Copeland et al., 2020). Stress takes a toll on our cognitive function, which can negatively impact our abilities to store information. Studies have shown that both music and the practice of mindfulness meditation strengthens brain function, which helps to enhance memory (Ferreri et al., 2013; Roozendaal et al., 2009). The current experimental study aimed to provide insight to pinpoint the benefits of how a single meditation along with music could improve memory recall, and their ability to aid one's cognitive abilities to remember words that are attempted to be stored in memory semantically. Participants were majority female 84.7%, Hispanic or LaxinX 42.4%, between the ages of 18 and 25 83.9%, and at or below poverty level 61.1%. It was expected that participants who listened to background music during encoding and recall as well as engaged in a mindfulness meditation would remember the most words. There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music $F(3)=1.47$, $P>.05$. Additional data collection, or a larger and more generalizable sample, would be necessary to increase the power of this study. This should not discount the individual benefits that both mindfulness meditations and music have independently shown in the past.

Key words: mindfulness, meditation, memory, recall, music, semantic memory, relaxation, body relaxation, body scans, mindfulness meditation,

In light of the recent outbreak of the Coronavirus Disease 2019 (COVID-19) that has impacted the world, there has been growing discussion about escalated rates of stress. In the United States of America (USA) college students are concerned about their health, health care, the state of the economy, and dramatic lifestyle shifts. Collectively, college students are experiencing increased levels of stress; and, prolonged stress takes a toll on our cognitive function, which can negatively impact our abilities to store and retain information (Conrad, 2011). It is possible that the consequence of this collective trauma could lead to a decrease in the ability to process and store new information in our brains. Fortunately, studies have shown that both music and the practice of mindfulness meditation strengthens brain function, which helps to enhance memory (Ferreri et al., 2013; Roozendaal et al., 2009).

Stress and Memory

Stress is a very useful adaptive phenomenon because it initiates an efficient physiological response to threatening situations. When the body becomes stressed, it can be useful in recalling memories almost automatically as a protective response. For example, when a person touches a hot surface, the brain remembers that heat causes pain, and therefore the person will usually move their hand away before they consciously think about being burned. However, prolonged stress can actually hinder memory. The prolonged social isolation, economic instability, and political chaos that we are currently experiencing, has created a heightened state of stress for the majority of the U.S. population. Psychobiologists say that prolonged stress can trigger an overproduction of hormones that actually change the structure of the amygdala and hippocampus, due to high levels of adrenaline, which can block memory enhancing neurotransmitters (Liang et al., 1986). This type of prolonged stress can lead to a decrease in the ability to encode new information.

Mindfulness And Memory

For over 2,500 years Buddhists have claimed that practicing mindfulness reduces suffering. Over centuries, mindfulness has evolved from a spiritual practice to a prevalent and secular health care intervention used to not only reduce pain and stress, but overall improve well-being and quality of life. Mindfulness has been defined as the awareness that emerges through purposely paying attention to the present, and nonjudgmentally unfolding one's experience from moment to moment (Kabat-Zinn, 2003). Like other natural baseline abilities, mindfulness can be modified and enhanced to reduce stress and improve quality of life (Kerr et al., 2011). Mindfulness meditation helps to decrease stress by returning the body into a state of homeostasis, which then increases brain function. Improving one's cognitive flexibility will subsequently reduce fatigue, especially during continuous exposure to stress-inducing scenarios; and, it will ultimately yield beneficial outcomes associated with cognitive functioning. One of the main physiological and psychological benefits of mindfulness is associated with reduced anxiety and stress, specifically in conditions that involve anxiety, depression, neuroticism, rumination, and distress contagions (Bergen-cico et al., 2013). Depending on an individual's needs, mindfulness has evidently demonstrated its potential as a natural buffer that can mitigate one's negative reactions to everyday stressors.

Mindfulness meditation is a form of clinical practice supported by evidence-based research for its efficacy in treating various physical and psychological conditions (Ramel et al., 2004). Typical mindfulness meditation practices could be performed in a variety of ways. In this modern era, guided audios are designed by Certified Mindfulness Practitioners. These guided audios consist of directed deep breathing exercises, body scans, and depending on the goal of the meditation, targeted language to enhance the experience. Various forms of meditation are taught, including seated meditations, where participants incorporate other foci such as breathing and thought exercises. Regardless of the type of mediation, mindfulness meditation requires great focus and challenges one's cognitive efforts against typical intrusive thoughts and emotions; therefore, it may be difficult to successfully execute at the beginning. During body scans, participants are instructed to focus their non-judgmental attention on sensations experienced through different areas of their bodies. This is supported by comparative observations on the increase of self-awareness due to the decrease of rumination. Mindfulness meditation is geared towards relieving oneself from psychological and, in many clinical cases, physiological burdens. This is done by employing a similar focus used during body scans, where individuals focus on certain sensations, such as breathing, pulse rate, and other bodily functions while negating distractors (e.g., thoughts, sounds, surroundings, etc.).

Since mindfulness practice originated from Buddhism, there has been ongoing debate between religious or spiritual text and the academic community about whether or not mindfulness can improve memory. A comprehensive literature review was conducted on

stress that emphasized that reducing the amount of adrenaline in the brain allows for more neurons to fire on the pathways between the amygdala and the hippocampus (Roozendaal et al., 2009). Clinical settings for psychotic patients have implemented 45-60 minute classes consisting of gentle movements and mindfulness practices that have significantly reduced the physiological response associated with levels of adrenaline in the brain (Russell & Arcuri, 2015). Since mindfulness practices can reduce adrenal levels in the brain pathways between the amygdala and hippocampus, cognition could be strengthened, which could improve emotional processing and memory.

The practice of mindful meditation has become increasingly popular because of the many benefits that it can have on the body, including brain function and one's ability to focus. Some research has been done on the cognitive effects of mindfulness, and the relationship between mediation practice and memory enhancement. Studies have indicated that frequent meditation practices help to strengthen and increase function in the cerebral cortex and hippocampus, two areas of the brain that play a key role in attention, perception, learning and memory (Tang, Holzel & Posner, 2015). Through neuroimaging, it has been observed that there are significant improvements on brain regions that are associated with attention, introspection, and affective processing, all of which are associated with how the brain processes memories (Tang, Holzel & Posner, 2015).

Mindfulness has become such an effective technique used to train your mind to improve your physiological state. Mindfulness Based Stress Reduction (MBSR) programs that consist of 8 to 10 week long retreats, including daily mindfulness activities and self-directed mindfulness practices, have shown statistically significant reductions in stress and the improvement of cognitive functioning (Bergen-cico et al., 2013). These elongated mindfulness immersion programs have improved the lives and cognitive abilities of people with stress disorders. Individuals who completed such programs returned to their regularly scheduled lives refreshed, and with many of the cognitive abilities (such as focus and memorization) that they had lost. The reason why MBSR programs were developed is because mindfulness practice requires a learning curve; therefore, enhanced benefits are shown overtime.

Music And Memory

People are exposed to background music regularly in their daily lives. Background music is often playing in restaurants, stores, and waiting rooms; and, most people have music playing while they are driving or just doing chores at home. Music is so powerful that it can influence our moods and emotions. For example, the movies and television shows we watch use background music to help set the mood and enhance the viewers experience. It is evident that music enhances our lives in many ways. In recent decades, scientific research has explored the impact music has on one's mental state and cognitive performance. It has now been suggested that music can aid in learning and even enhance memory.

Previous research studies have shown that music presented during the encoding process has a positive impact on memory during memorization and recall tasks, which is most likely due to the fact that auditory stimulation deactivates the prefrontal lateral cortex (Ferreri et al., 2013). Thus, it provides richer contact for encoding because there is less demand on the prefrontal lateral cortex (Ferreri et al., 2013). Later research supported previous findings that music aids in verbal encoding in order adults (Ferreri et al., 2014). These findings suggest that music affects the brain's neurocognitive state by calming down brain activity, therefore increasing its capacity to process and encode new information (Ferreri et al., 2014).

One thing we need to consider in this type of research is the genre of music being listened to, as well as the tone and tempo. It has been suggested that fast, up beat music with vocals could have a negative effect on learning and recall, compared to calming instrumental music (Cassidy & MacDonald, 2007). Some research has indicated that listening to popular music with vocals actually decreases performance in memory recall tasks, suggesting that certain types of music may be too distracting and can impair learning and memory encoding (Cassidy & MacDonald, 2007). It was also found that calming music significantly improved cognitive function and performance during memory tasks (Cassidy & MacDonald, 2007). Research still has yet to determine, however, if music affects cognitive function directly; or, if arousal and change in mood are directly responsible for these cognitive enhancements. This is a topic that should be explored.

Background music increases the activity of neural mechanisms that are responsible for focus and attention. In the field of Cognitive Science there is much research to support that music helps to improve memory and focus. Functional near-infrared spectroscopy (fNIRS) has been used in past studies to measure and record the difference in brain activity during encoding and memory recall. An experimental study that was conducted on older adults in their sixties, took fNRIS neuroimaging measurements while participants were asked to complete encoding and retrieval tasks by being presented with a list words while either listening to music or in silence; and, this study concluded that there was a higher recollection of words for participants who were in the music condition (Ferreri et al., 2013). This research suggests that stimulating the dorsolateral prefrontal context during encoding and recall tasks causes a positive level of arousal that improves memory (Ferreri et al., 2013).

Current Study

Mindfulness meditation is stated to be a practice that should be learned over time. Since there is little research on the effects of a single mindfulness meditation, we were interested in how a single mindfulness meditation might impact the conscious mind's ability to encode and consolidate information into long term memory using semantic representations and a musical aid. This intervention could provide an innate tool that is free and can be practiced from anywhere in the world. Therefore, this current study will be instructing participants to attempt to encode a list of words into their long term memory using semantic cues, by mentally visualizing a word list. Our research aimed to provide additional information to pinpoint the benefits that a single mediation might have on memory recall, in order to understand the full range of effects mindfulness can have in daily life.

Purpose

Based on the plethora of knowledge provided by the experts from various fields, the current study aims to provide evidence that two simple leisure activities can improve memory while simultaneously reducing stress and improving cognitive functioning. It was hypothesized that participants who completed the mindfulness meditation task would recall more words than those who participated in the distraction task. It was also hypothesized that participants who listen to background music during word memorization and recall tasks would recall more words than those who did not listen to background music. Finally, it was hypothesized that participants who listen to background music during the word memorization and recall tasks, in addition to completing the mindfulness meditation task, would recall significantly more words than participants in other conditions.

Variables

The independent variables in this experiment were meditation and music. The meditation variable consisted of two levels, either with meditation or with no meditation (which consisted of a distraction task). The meditation was operationally defined as a 10 minute, prerecorded, guided meditation consisting of breathing exercises, body scans, body relaxation techniques, and practicing self-compassion. The distraction task was operationally defined as a 10 minute, implicit association test (IAT), that tested instant positive or negative associations for insects or flowers. The music variable also consisted of two levels, which were either with background music or with no background music. The music was operationally defined as a 3 minute and 30 second instrumental acoustic jazz piece, titled "If you see my mother" by Sidney Bechet. Condition 1 consisted of both the mindfulness meditation and background music. Condition 2 consisted of the mindfulness meditation and no background music. Condition 3 consisted of both the distraction IAT and background music. Condition 4 consisted of both the distraction IAT and no background music. The dependent variable in the experiment was the number of correct words that were recalled within a time span of 3 minutes and 30 seconds.

Method

Participants

Participants were students recruited from California State Polytechnic University, Pomona, Psychology Department, and who were currently students attending a traditionally face-to-face institution that was converted to an online format as a COVID19 safety precaution. The students took the online experiment for course credit. Participants were majority female (n=50) at 84.7%, between the ages of 18 to 25 (n=24) at 84.5%, Hispanic or LaxinX (n=25) at 42.4%, and at or below poverty level. The following tables include a full breakdown of the demographic information of the participants that was collected. Participants reported gender (n=59) was 15.3% male and 84.9% female. Participants reported ages (n=58) were 41.4% 18-21, 42.5% 22 to 25, 6.8% 26 to 29, 5.1% 30 to 32, 1.7% 33 to 36, and 1.7% 40+. Participant's reported race/ethnic identities (n=59) were 18.6% White, 5.1% Black or African American, 5.1% American Indian or Alaska Native, 15.3% Asian, 1.7% Native Hawaiian or Pacific Islander, 42.4% Hispanic or LatinX, 3.4%

Middle Eastern, 6.8% Multi-Racial, and 1.7% French. Participant's reported household income level was 15.3% less than $10,000, 10.2% between $10,000 and $19,999, 22.0% between $20,000 and $29,999, 13.6% between $30,000 and $39,999, 8.5% between $40,000 and $49,999, 5.1% between $50,000 and $59,999, 6.8% between $60,000 and $69,999, 3.4% between $70,000 and $79,999, 1.7% between $80,000 and $89,999, 5.1% between $90,000 and $99,999, 3.4% between $100,000 and 149,999, and 5.1% at $150,000 or more.

Materials

Guided Meditation Selection

The mindfulness meditation that was selected for the current study was designed by a Certified Mindfulness Practitioner, Alane Daugherty, Ph.D.; who, is a full-time professor and Stress Management expert at California State University, Pomona. The mindfulness meditation was a 10-minute long pre-recorded guided audio that instructed the participant to close their eyes, be aware of their breathing, engage in a relaxation and practice self-compassion. The link to the guided meditation link is as follows: https://drive.google.com/file/d/13cluXXjAB_Ub7uoI4l8537aboAFfF2Lq/view?usp=sharing

Music Selection

The condition with music consisted of an acoustic instrumental jazz piece titled "If you see my mother (Si tu vois ma mère)", by Sidney Bechet. The length of the musical piece was 3 minutes and 30 seconds. This music selection had successfully been used in prior research studies, and was applied to this study (Ferreri et al., 2013, 2014). The link to the music selection is the following: https://youtu.be/WNdzbdSpf9I

Word List Selection

The word list was made up of 30 different words. The words consisted of a variety of both concrete and abstract words (e.g. bubbles, adorable, lather, kettle). The words varied in both length (3 to 9 letters) and syllables (1 to 4 syllables). Words were presented on a computer screen, one at a time, for 6 seconds each. The length of the word memorization task was 3 minutes and 30 seconds long. The words were pulled from a list of words (found on table 5) that were used in a prior word recognition and recall study (Huff & Hutchison, 2011). The words were carefully selected from this list to ensure they had no synonyms designed to entice false memories. The amount of words (30) was selected because prior research supported the use of 30 words on a 25 minute long survey; and reported good reliability and validity (Judde & Rickard, 2010). The words selected for this study are provided in the Appendix.

Implicit Association Test (IAT) Selection

The implicit association test (IAT) was custom designed for this study and served the purpose of a distraction task (Carpenter, 2015). The IAT tested for positive and negative word associations of flowers and insects. The IAT task was 10 minutes long, and served

the sole purpose of keeping participants engaged while occupying their attention. Iatgen software was used to construct this test (Carpenter, 2015).

Demographic Questionnaire Selection

The demographics questionnaire was broken down into four categories, and assessed for age, gender, socioeconomic status and ethnicity. This information was primarily used to describe the sample.

Procedure

Participants were asked to take part in a 2 (Music: Music or No Music) x 2 (Mindfulness Task: Meditation or Distraction IAT task) factorial online experimental study that was distributed on Sona via Qualtrics. They were informed that the online experiment would be able to be completed in approximately 30 minutes or less. Participants were first asked to formally agree to participate in the experimental study by signing an informed consent form. All Participants were informed that they would participate in a 3 minute and 30 second word memorization task, where they were asked to memorize a list of 30 different words; and that each word was individually presented on screen for 6 seconds each. Participants were randomly assigned to complete the word memorization task under one of two conditions; either with background music, or without background music. After the memorization task was completed, participants were again randomly assigned to participate in either a 10 minute guided mindfulness meditation task, or a 10 minute distraction task using an Implicit Association Test (IAT). After the mindfulness meditation or IAT tasks were completed, participants were asked to reflect on their experience with the task that they had been assigned to. They were asked to report any feelings and emotions they had experienced. Next, the participants were instructed to complete a 3 minute and 30 second word recall task, by typing out as many words that they could remember in any order. During the word recall task, participants who had participated in the music condition, also completed the word recall task while listening to the same song; and, participants who did not participate in the music condition were instructed to complete the recall task without music. Participants who had been assigned to the music condition were instructed to listen to the music at a comfortable volume. Participants were then asked to provide some demographic information. Finally, participants were instructed to read a debriefing statement in order to receive their SONA credit.

Results

A sample of 70 responses was collected for this experiment, however it was obvious that some participants skipped the meditation and/or music videos; therefore, 11 participants were excluded for completing the experiment in under 600 seconds.

This experiment was a 2x2 factorial design: 2 (Music: Music or No Music) x 2 (Mindfulness Task: Meditation or Distraction IAT task) between subjects analysis of variance (ANOVA) with a Tukey Post Hoc analysis was conducted on the number of words correctly recalled. Figure 1 and 2 below represent the number of words correctly recalled in each condition as well as the number of participants that completed the experiment, in each condition.

The analysis did not include any significant main effects or interactions. Participants in Condition 1: mindfulness meditation and background music recalled insignificantly more words (M = 10.1, SD = 6.4) than participants in Condition 2: mindfulness meditation and no background music (M = 7.2, SD = 7.7). Participants in Condition 3: distraction IAT and background music recalled insignificantly more words (M = 11.2, SD = 6.7) than participants in Condition 4: mindfulness meditation and no background music (M = 7.1, SD = 4.6). There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music F(3)=1.47, P>.05. There were no significant differences in memory recall when participants practiced mindfulness meditations or listened to music F(3)=1.47, P>.05. The results did not support that neither mindfulness meditation or music improve or aid memory recall. Figures are included in the Appendix E of our data.

Discussion

Although this study had no significant findings, we feel that it is very important not only to understand the cognitive influences this type of stress has on the human brain, but how to facilitate aiding cognitive abilities in a safe way. Especially considering the fact that many populations of people are currently being impacted by COVID in an infinite number of ways. It is very important to find ways to provide ourselves with emotional management tools that could protect our physiology and our immune system. The current situation really limits our ability to rely on the affections and comforts of social presence, that we became so accustomed to. Since the COVID-19 pandemic has had such a powerful influence on college student's stress levels, research needs to be done to figure out healthy ways to moderate those potentially negative effects in a manner that does not risk exposure.

Prior research has taught us that prolonged stress affects neural pathways in the brain, hindering our ability to encode and recall information (Roozendaal et al., 2009). This type of research has provided insight into the complexity of neural and cognitive function and the many different aspects of memory. Comparatively, several studies have also shown that there are methods we can implement into our daily lives that can effectively improve cognition and memory. These research studies give us a greater understanding of just how much an individual's mental state can impact their overall physiology. This type of knowledge creates an awareness that can help people to maintain efficient cognitive function and greater mental health.

The hypothesis that participants who listen to background music during word memorization and recall, as well as engaging in mindfulness meditation, would recall significantly more words, was unable to be confirmed according to the results of this experiment. There were no significant differences between all four condition groups. Overall, participants in the music conditions did recall more words than those who did not listen to music during memorization and recall, but the mean scores were not significant. Though mindfulness meditation did not show significant effects in this experiment, additional studies with shorter meditation tasks may result in greater differences. It would be beneficial to expand on this research in the future.

Limitations

There are a number of limitations that need to be mentioned. The sample of participants was a majority of Hispanic or LatinX, female, low-socioeconomic status, and under the age of 25 which is not representative of the general population. It would have been preferable to collect a larger sample that was more proportionate of the general population to make more meaningful conclusions.

We did collect a reflection of how the participants were feeling after participating in each task. Although this reflection was simply used to allow the participant time to process their emotions after participating in the mindfulness meditation, it also provided some insightful information that disclosed how many participants reported feeling negative (n=17) 28.8%, neutral (n=9) 15.3%, or positive (n=31) 52.5%. It is important to note that although the distraction task was not designed to make people feel agitated, frivolous tasks could make participants feel more negative than positive. The length of the meditation and implicit association test may also have been too long, contributing to the negative feelings that people reported feeling (e.g. boredness, agitation, anxiousness, etc.).

Due to this study being administered virtually, we were unable to control for multiple factors that may have impacted our results. There was an inability to control the environment that the participants were in, therefore background distractions, participant's posture, and the participant's engagement in the memorization and meditation tasks could not be guaranteed. Additionally, we were unable to control the volume of the music and meditation, which may have hindered the effectiveness of these conditions. Lastly, there was no way to control for thorough and proper completion of the experiment in its entirety. We are confident that engagement was an issue in this experiment due to the fact that most participants took a questionably low amount of time to complete the experiment. All of these virtual related factors may have negatively impacted the validity of the results.

Recommendations

It is recommended that future replications of this study increase the target sample size, as well as attempt to recruit a more diverse sample population. Implementing a cap on the amount of participants who complete the survey that is proportionate to the general population.

In the event that this experiment is replicated, it is also recommended that the experimenter rethinks the distraction task all together. It may be beneficial to have the participants complete a distraction task that is expected to promote feelings of positivity, similar to the mindfulness meditation conditions. This experiment can be replicated virtually in two different formats: synchronously or asynchronously, based off of the following recommendations. It is recommended that future researchers who are considering replication of this study synchronously, meet via zoom to supervise the participants while they complete the experiment. This would control for the environmental concerns that are current threats to validity of this experimental design. Additionally, this would also ensure that participants complete the study in its entirety. If a future researcher would like to replicate this study asynchronously, advanced coding techniques would be necessary.

Software that is more invasive, and has more control over the participant's computer screen would be beneficial. Participants were able to skip through the mindfulness meditation and the stimulus tasks because they were presented as videos. Therefore, controlling the videos so that they are forced to play in their entirety, by enabling an auto advance, would be very important. One would also consider utilizing an eye tracker, or making the participant think that an eye tracker is being utilized.

Because prior research indicates that mindfulness meditation and music can have positive effects on cognition and memory, it is suggested that further research be done on this topic.

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APPENDIX

ITEM A

Word List

Stripes	Concrete	Chew	Glass	Delicate	Cane
Zoo	Point	Robe	Frail	Promise	Lollipop
Plain	Banner	Lather	Pane	Cork	Adorable
Official	Bubbles	Tide	Saucer	Sweet	Fudge
Possum	Kettle	Teeth	Cookie	Bee	Polite

Software that is more invasive, and has more control over the participant's computer screen would be beneficial. Participants were able to skip through the mindfulness meditation and the stimulus tasks because they were presented as videos. Therefore, controlling the videos so that they are forced to play in their entirety, by enabling an auto advance, would be very important. One would also consider utilizing an eye tracker, or making the participant think that an eye tracker is being utilized.

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APPENDIX

ITEM B

Questionnaire

Incorrect Device Notification

The survey software has detected that you are attempting to take this survey from an incompatible device. The survey contains questions that will only function correctly on a computer with a keyboard. Please open this survey from a computer with a keyboard.

Informed Consent

Experimental Psychology Fall, 2020 Undergraduate students at California State Polytechnic University Pomona enrolled in an Experimental Psychology course (PSY 4433), supervised by Dr. Bonnie Thorne, are testing volunteer participants for the purpose of learning how to conduct experiments. We appreciate your participation, as it will aid our understanding of how to conduct valid research in the future.

Description: This study is designed to test memory recall. As a participant, you will be given three and a half minutes to attempt to memorize a list of 30 of words into your long-term memory. Next, you will engage in a 10-minute task that could consist of a mindfulness meditation or an implicit association task. When the task is completed you will be asked to report information about how your experience was participating in the task. You will then be asked to recall the list of words from the first portion of the survey. Finally, you will be asked to provide demographic information that will help us describe our sample.

Although we could learn about how to conduct experiments by just studying procedures in class, we feel that actually conducting experiments is the best way to ensure a solid understanding of how to conduct valuable and meaningful research. We do not anticipate the study will present any physical, psychological, social, legal, economic, or other risks to you, other than the possible inconvenience of the time for you to participate. Participation in this study may not benefit you directly. We will ask you for your name as a record of having participated in this experiment and having given your informed consent. However, the data is confidential. We will not release data about you or your performance in this study to anyone else in a way that could identify you. If you want to withdraw from the study at any time, you may do so without penalty. The information collected from you up to that point would be destroyed if you so desire. If you are participating for course credit, this experiment is worth 0.5 credit(s) Once the study is completed, we would be glad to give you the results.

Contact Valerie Tapia at vtapia@cpp.edu or Audriana Gregorio at amgregorio@cpp.edu. If you have any questions, please ask us or contact Dr. Bonnie Thorne, bthorne@cpp.edu or (909) 869-2281. If you have complaints about your treatment as a participant, please call or write: Chair, Human Participants Committee, c/o Research and Sponsored Programs, California State Polytechnic University Pomona, Pomona, CA, 91768, (909) 869-2966. Although the chair may ask your name, all complaints are kept in confidence.

Consent

By typing your name in the box below, you confirm that you are at least 18 years old and that you understand that your participation is voluntary, and you consent to participate.

Instructions

Please make sure the volume on your device is at a comfortable level and that nothing is playing in the background. Some of the tasks in the following experiment will require you to hear. Please make sure you are sitting in a comfortable position. Some of the tasks in the following experiment will require you to be seated comfortably. Once you advance to the next page, a timer will start. You will have three seconds to press play on the video. So, press play immediately. The video will display a list of 30 words. Each word will be displayed for 6 seconds. Try your best to store these words into your long term memory, as you will be asked to recall this list of words at the end of this survey. In order to help you remember the words for longer, try to visualize each word presented.

Condition 1: Memory Stimulus with Music

Instructions: Please make sure your volume is up. Remember, try to visualize every word you see to help you remember it for longer. Press play.

Memory Stimulus With Music Video Played Here

The page will auto-advance momentarily.
o Ok.
Condition 2: Memory Stimulus Without Music

Instructions: Remember, try to visualize every word you see to help you remember it for longer. Press play.

Memory Stimulus Without Music Video Played Here.

The page will auto-advance once the video is over.
o Ok.

Condition 3: Mindfulness Meditation

The page will auto-advance once the video is over.
o Ok.

Pre-IAT Instructions

The following task will ask you to select the "E" key if the word belongs to the category on the left and "I" key if the word belongs to the category on the right. Please make sure you read and understand the instructions, before you begin the task.
Implicit Association Test (Distraction Task)

This test was a virtually coded test designed on www.iatgen.com. It instructed participants to make positive and negative associations of insects and flowers.

Questions After Task

Please describe any emotions you are currently feeling.

_____

Please reflect and summarize your experience with the previous task.

_____

Instructions for Recall

On the next page, you will be asked to recall the list of words that you were asked to remember at the beginning of the survey. You will have 3 minutes and 30 seconds to complete the task. You do not have to remember the words in any particular order. Please proceed.

Instructions for Memory Recall with Music

Please press play on the video below, and then begin recalling the list of yours you were asked to remember at the beginning of the survey.

Please list the words you were asked to remember at the beginning of the experiment

1.___	6.___	11.___	16.___	21.___	26.___
2.___	7.___	12.___	17.___	22.___	27.___
3.___	8.___	13.___	18.___	23.___	28.___
4.___	9.___	14.___	19.___	24.___	29.___
5.___	10.___	15.___	20.___	25.___	30.___

Memory Recall without Music

Please begin recalling the list of yours you were asked to remember at the beginning of the survey. Please list the words you were asked to remember at the beginning of the experiment.

1.___	6.___	11.___	16.___	21.___	26.___
2.___	7.___	12.___	17.___	22.___	27.___
3.___	8.___	13.___	18.___	23.___	28.___
4.___	9.___	14.___	19.___	24.___	29.___
5.___	10.___	15.___	20.___	25.___	30.___

Demographics

Please provide demographic information about yourself below

What is your age?_____

Choose one or more genders that you consider yourself to be:

▢ Male

▢ Female

▢ Non-Binary _____

Choose one or more races that you consider yourself to be:

▢ White

- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Other _____

Information about income is very important to understand. Would you please give your best guess?Please indicate the answer that includes your entire household income in (previous year) before taxes.

oLess than $10,000
o $10,000 to $19,999
o $20,000 to $29,999
o $30,000 to $39,999
o $40,000 to $49,999
o $50,000 to $59,999
o $60,000 to $69,999
o $70,000 to $79,999
o $80,000 to $89,999
o $90,000 to $99,999
o $100,000 to $149,999
o$150,000 or more

Debriefing

Thank you for your participation in this experiment! Please do not discuss the details of this research with other students, as they may participate in this or similar studies in the future. The goal of this study was to determine the effect of mindfulness meditation and music on long-term memory. The purpose of this study is to inform the field of psychology from a cognitive processes perspective on how holistic interventions can impact cognition. A potential benefit of this study is that results would help us better understand how relaxation techniques improve cognition in real-world settings face.Your participation is not only greatly appreciated by the researchers involved, because the data collected could possibly provide evidence relevant to how to aid telehealth students and workers. In this experiment, you were instructed to complete an encoding task. During the encoding task you could have been either listening to music or not. Next, you were randomly assigned to either a distraction task or a mindfulness task. After that, you were asked to reflect on your experience with the task you completed. You were then provided with a form that allowed you to report the words you were able to recall. Finally, you answer demographic questions that will help us describe our sample. If you have any questions or concerns about this study, please contact:

Primary Investigator: Dr. Bonnie Thorne, bthorne@cpp.edu, California State Polytechnic University, Pomona, Psychology Department, West Temple Avenue, Pomona, CA, 91768

Co-Primary Investigator: Valerie Tapia, vtapia@cpp.edu, 909-631-3206

Co-Primary Investigator: Audriana Gregorio, amgregorio@cpp.edu, 951-538-4894
Finally, we urge you not to discuss this study with anyone else who is currently participating or might participate at a future point in time. As you can certainly appreciate, we will not be able to accurately examine participants who know about the true purpose of the project beforehand. Press the "Next" button to end the survey and return to Sona to receive automated credit for completing the study.

Thank you!

APPENDIX

ITEM C

Video Links

Condition 1: Memory Stimulus with Music

- https://youtu.be/bcqOCp1A63M

Memory Recall with Music

  o https://youtu.be/Ko0veDQ-6kk

Condition 2: Memory Stimulus Without Music

- https://youtu.be/4SRkAZQvVR4

Memory Recall without Music

  o No video

Condition 3: Mindfulness Meditation

- https://youtu.be/lrKUJ7cMzpk

APPENDIX

ITEM D

Demographic Information Tables

Table 1. Participant's reported gender (n=59).

Male	15.3%
Female	84.7%

Table 2. Participant's reported age (n=58).

18 to 21	41.4%
22 to 25	42.5%
26 to 29	6.8%
30 to 32	5.1%
33 to 36	1.7%
40+	1.7%

Table 3. Participant's reported race/ethinic identity (n=59)

White	18.6%
Black or African American	5.1%
American Indian or Alaska Native	5.1%
Asian	15.3%
Native Hawaiian or Pacific Islander	1.7%
Hispanic or LatinX	42.4%

Middle Eastern	3.4%
Multi-Racial	6.8%
French	1.7%

Table 4. Participant's reported household income level (n=59).

Less than $10,000	15.3%
$10,000 to $19,999	10.2%
$20,000 to $29,999	22.0%
$30,000 to $39,999	13.6%
$40,000 to $49,999	8.5%
$50,000 to $59,999	5.1%
$60,000 to $69,999	6.8%
$70,000 to $79,999	3.4%
$80,000 to $89,999	1.7%
$90,000 to $99,999	5.1%
$100,000 to $149,999	3.4%
$150,000 or more	5.1%

APPENDIX

ITEM E

Results Figures

Figure 1: Results

Figure 2: Number of Participant in each Condition

Vargas
Jesus

Exploring Opportunities for Rare Wool: Product Development, Digital Marketing, and a Pilot Consumer Study

Abstract

Sustainable fashion has been more prominent in the industry due to consumer movements seeking to increase transparency, environmental, and ethical principles in the apparel production supply chain. Although sustainability has risen in significance, global fiber production is primarily synthetic made from non-renewable resources. The use of sustainable, natural fibers are yet to be utilized at a scale that can enact real change to support environmental, social, and economic sustainability. This study contributes to sustainable fashion research by exploring creative opportunities with rare wool as a slow fashion approach. Wool is a natural, renewable resource that has been produced in the U.S. for centuries; more recently, there are efforts to conserve endangered sheep breeds that produce diverse fibers for clothing and textiles. An educational overview of research regarding sustainable fashion, consumer studies, U.S. wool, rare wool, sheep farms, and digital marketing is provided. With the rising abundance of textile materials, this study aims to contribute to the conversation of sustainable fashion by exploring opportunities for the usage of "rare" wool fibers. This is a three-part research study that involves (a) product development with rare wool fibers, (b) ideation of digital marketing for rare wool fiber products, and (c) a pilot study to understand consumer's interest in slow fashion, sense of empowerment, and perceptions of rare wool digital marketing ideations. By exploring the wool market and developments in consumer research, this study aims to generate consumer awareness of sheep and wool conservation efforts, and value to both producers and consumers to expand research in sustainable and slow fashion.

Introduction

Throughout the last 20 years, 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 (Henninger et al., 2016; Moorhouse, 2017). Sustainability has become a driving force in uplifting industrial methods and practices of past generations through technology, developments, and initiatives (Ertekin & Atik, 2014). The aim is to regain a healthy balance between the apparel industry and the environment that surrounds it (Cattermole, 2018). Within the apparel industry, studies have noted sustainable fashion as a two-way concern in which both producers and consumers are called to transform institutional practices (Ertekin & Atik, 2014). Although sustainability risen in significance, sustainable fiber and material use has slowly progressed and is yet to see the industrial speed and scale required, which would allow it to enact material change within an industry (Textile Exchange, 2020).

Over the past two decades, the textile and apparel industry has caused great damage through excessive consumption patterns and trends which have resulted in pollution, waste, environmental degradation, and the decline of economic well-being (Ertekin & Atik, 2014). In a recent Preferred Fiber Report by the Textile Exchange (2020), global fiber production reached an all-time high of 111 million metric tons (mt) and is projected to steadily rise by 30 percent in the next 10 years. Most industrial waste and pollution is created from synthetics materials, which compose 52% of the market as compared to natural materials which make

up around 30%. Unfortunately, only 14% of synthetic materials are recycled. Therefore, if the industry continues to overwhelm the market with unsustainable materials, we will reach an ecological threshold. 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; however, to do so will require producer and consumer engagement to excel at personal and societal levels to advance awareness and preference towards sustainable, renewable fibers, and material use.

Although wool makes up only 1% of the total fiber used in the apparel industry (Textile Exchange, 2020), it is supporting a shift towards sustainability. Wool is a naturally occurring fiber produced by sheep, which offers a great range in versatility and usage. With the fiber's renewable and natural properties, sustainability and biodiversity can play a critical role in developing new methods and practices that directly enhance its ethical and environmental surroundings (Granskog et al., 2020). However, a rising concern and focus on endangered "rare" sheep breeds have pushed producers and farmers to explore markets and opportunities for the usage of rare wool fibers. To increase awareness for rare wool, The Livestock Conservancy (2019), a non-profit organization, created an initiative called "Shave 'Em to Save 'Em," to encourage and promote the usage of rare wool and the development of heritage sheep breeds by extending knowledge about wool to the broader public. Through this initiative, there are greater opportunities for producers to reach consumers and create a sustainable network that allows the expansion of product development and marketing for sustainable materials.

With the rising abundance of textile materials, this study aims to contribute to the conversation of sustainable fashion by exploring opportunities for the usage of "rare" wool fibers. This is a three-part research study that involves (a) product development with rare wool fibers, (b) ideation of digital marketing for rare wool fiber products, a sustainable, renewable material, and (c) a pilot study to understand consumer's interest in slow fashion, sense of empowerment, and perceptions of rare wool digital marketing. By exploring the wool market and developments in consumer research, this study aims to generate consumer awareness of sheep and wool conservation efforts, and value to both producers and consumers to expand research in sustainable and slow fashion.

Literature Review

Issues in the Fashion Industry

Fashion is driven by mass consumption. Between 2000 to 2014, the number of garments purchased by an average consumer annually increased by 60 percent (Koszewska, 2018). During this time, the apparel industry saw a constant flow of newness and cheaply priced products marketed and consumed bi-weekly, which limited consumers knowledge of ethical and environmental issues surrounding production and consumption (Ertekin & Atik, 2014; Henninger et al., 2016). Constant cycles of fast consumption aligned with efforts to support the fashion system's overall economic well-being (Ertekin et al., 2014). In response to overconsumption of fashion cycles, sustainability offers the apparel industry an opportunity to develop a new model and economy, which does not rely on the traditional linear model of "Extract", "Create," "Use", and "Dispose."

If the industry continues the linear model economy of "Extract-Create-Use-Dispose" in the next 10 years, production and consumption will put a strain on the environment and stretch our resources to a breaking point (Koszewska, 2018). The circular economy promotes closed-loop, ethical production and consumption, which fundamentally extracts maximum value from resources to "Reduce", "Reuse," and "Recycle" (Cattermole, 2018).

Sustainable Fashion

As sustainability has risen to the forefront in every sector of the apparel industry, producers and consumers are more knowledgeable of the impact clothing manufacturing has on the environment and society (Henninger et al., 2016; Moorhouse, 2017). Consumer's awareness of the situation has increased consumer demand towards the apparel industry to change their practices (Bly et al., 2015; Henninger et al., 2016). Although consumers' exiting the fashion system might seem more sustainable through buying second-hand clothes or making clothes as an act of sustainable consumption (Bly et al., 2015); it does not support the overall change that will prevent or de-escalate the present and future state of unsustainable materials. Therefore, it is the responsibility of the fashion system to invent and create a new cultural meaning in modest and radical ways that will induce change and reflect a sustainable model that is economically viable for future businesses (Ertekin & Atik, 2014). Sustainability has encouraged many new perspectives in fashion; however, as awareness grows, industry efforts must emerge and meet the challenges of the fashion system by implementing new concepts that integrate environmental and ethical benefits (Cattermole, 2018; Henninger et al., 2016).

Slow Fashion. Sustainable fashion developed from awareness of the impact clothes have on the environment and ethical standards (Henninger et al., 2016). The slow fashion movement is part of broader sustainable fashion efforts (Fletcher, 2008). It aims to reduce the number of collections, emphasizes balance, and encourages quality products that are made to last as opposed to the fast fashion cycle of consumption (Cattermole, 2018; Ertekin & Atik, 2014; Henninger et al., 2016). However, slow fashion is a broader concept than just environmental sustainability alone. It encompasses care for producers and local communities, history for sustainable perceived value of products, diversity, and maximizing efficiency for a sustainable environment (Jin & Jung, 2014). By slowing down production, the slow fashion movement offers sustainable ways to produce clothes, which can lead the apparel industry towards improving ethical and environmental standards.

For slow fashion to emerge as a sustainable fashion model, the entire supply chain must focus on transparency, ethical conduct, principles of sustainability, and fostering long-term relationships (Ertekin & Atik, 2014; Henninger et al., 2016). To enact change, sustainable fashion must be collaborative. A study by Ertekin and Atik (2014) examined the potential large-scale transition to a slow fashion model. The lack of globalization, economic growth, resources, awareness, trust, and an attitude-behavior gap from both producer and consumers were a roadblock in the development of a sustainable model economy. Therefore, to adjust to this concept of sustainable fashion, an entire industry effort is necessary to advance sustainable solutions and collaborations to the scale required to induce industry change (Cattermole, 2018). The Sustainable Apparel Coalition, a collaborative organization is working towards reducing the environmental and social impacts

of apparel, footwear, and textile products globally. This is a perfect example of industry collaboration towards fundamentally transitioning towards a sustainable fashion model economy.

Consumer Perceptions of Sustainability. Various studies evaluate consumer perceptions of sustainability. A study by Ertekin and Atik (2014) noted that consumer awareness and transition towards sustainability is a two-way concern, in which both producers and consumers are required to transform institutions in order to shift towards a healthier balance and well-being. However, most consumers are unaware of the negative effects that fashion production and consumption have; their clothing requires intensive resources (Water, Energy, Raw materials, Chemicals), and puts a strain on our environment (Cattermole, 2018). Due to the lack of knowledge and awareness towards sustainability, consumers are not able to fundamentally grasp a holistic definition and perspective towards the real concept of sustainable fashion and consumption (Henninger et al., 2016). Since the term is often difficult to define and even harder to act upon, consumers tend to interchangeably mix sustainability with "ethical", "recycled", or "organic" labels, which further creates different perspectives regarding the concept itself (Henninger et al., 2016; Bly et al., 2015). Nonetheless, some consumers are reluctant and afraid to change their lifestyles due to the perception that sustainable fashion means giving up or losing material benefits. This results in consumers creating their own definition of the term based on their perceptions and experiences with the concept (Ertekin & Atik, 2014; 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 due to misperceptions (Bly et al., 2015).

Sustainable fashion is often perceived by consumers as a more expensive product that is developed for a good cause. A sustainable fashion system should counter consumers' preferences for cheap products especially when the desired outcome is to extract maximum value from resources to obtain long lasting durability (Cattermole, 2018). Furthermore, consumers realize that choice and excessive consumption does not necessarily increase happiness or improve quality of life, but instead promotes pollution and waste within the apparel industry (Henninger et al., 2016). Consumers who act upon such ethical concerns can induce change in production and marketing activities with their purchasing power (Cattermole, 2018; Sneddon et al., 2014). With resourceful information, consumers can then act upon their perceptions of sustainability and ultimately dictate their own sustainable fashion and consumption efforts. A study by Bly, Gwozdz, and Reisch (2015) noted that sustainable consumer pioneers often mistrust major fashion retailer sustainable efforts due to their awareness of hyper consumption. They acknowledge that an exit from the fashion system allows for less guilt over their consumption frequency and empowers them to explore garments' aesthetic and physical durability through repairing, re-purposing, or recycling. Therefore, sustainability for consumers can involve reducing measurable effects and incorporating concepts that explore freedom, uniqueness, resistance, authenticity, trust, and well-being. Currently, social media and e-commerce play a critical role in bringing sustainable consumer pioneers together; thus, creating empowerment and innovative content for co-creating new visions that rely on sustainable production and consumption (Bly et al., 2015).

There are many barriers that have delayed consumers' transition towards sustainable fashion. Consumers experience an attitude-behavior gap and lack of transparency, knowledge, awareness, and trust when transitioning towards sustainable fashion and consumption (Ertekin & Atik, 2014). Consumers can resist change, at first, as there seems to be a gap between consumer attitude and actual consumption behavior towards sustainability. Consumers acknowledge information, but do not change their habits for the better. Additionally, the disconnect of resource origin, environmental consequences, and the detachment from production creates a barrier for consumers and ultimately distorts their perception towards sustainability within the apparel industry (Bly et al., 2015). Transparency within the industry and supply chain plays a critical role in sustainable fashion and in enhancing consumers perceptions towards the concept alone (Sneddon et al., 2014). Transparency allows consumers to verify claims from manufacturers and labels from the beginning to end and also allows consumers to be considerate of sustainability issues (Henninger et al., 2016).

Slow fashion consumer research has slowly emerged over the past decade as slow fashion consumers seek unique items that empowers them. A study by Jung and Jin (2014) evaluated the underlying dimensions for Consumer Orientation towards Slow Fashion (COSF). They identified five key factors of slow fashion including equity, authenticity, functionality, localism, and exclusivity, which are inclusive of environmental and social sustainability. Consumer segments were further identified based on the five dimensions (Jung & Jin, 2016; 2014); each segment was profiled based on consumers' personal values, consumption behaviors, and demographics. Four primary groups were identified: (1) those that were highly involved in slow fashion (35%); (2) conventional with preference for functionality (29%); (3) exclusivity-oriented (23%), and (4) low involvement in slow fashion (12%). Group 1 was highly involved in slow fashion and were most willing to buy and pay for slow fashion due to their awareness; they expressed willingness to pay 30-40% more. They personally cared for others, while seeking to enhance themselves with achievements. They identified as conservative, yet open-minded to change their own self-direction. The results from Group 1 indicate that there is a consumer base that is willing to pay a higher amount and spend more money if their slow fashion values are aligned with the products. Further research can help verify these findings.

Accordingly, efforts need to be made both on a personal and societal level to support sustainable consumption habits and increase awareness among consumers. By appealing to logic, publicizing innovations, and partnering with powerful actors in the apparel industry, consumer awareness and behavior can be directed towards sustainable fashion consumption (Cattermole, 2018). Therefore, consumer perceptions of sustainability should include transparency, environmental principles, viability, freedom, and well-being. Consumers will ultimately create their own holistic definition of sustainable fashion and consumption based on greater knowledge and awareness.

Wool

Wool fibers are naturally occurring and are produced by sheep in a variety of natural colors, textures, and diameters, which offers a great range in versatility and usage. With the fiber's renewable and natural properties, sustainability and biodiversity play a critical role

in enhancing ethical and environmental aspects of clothing and textiles (Granskog et al., 2020). The fiber is often considered to be more sustainable than others due to its ability to be managed more efficiently, as a surge of initiatives and accreditations have improved animal welfare and land management practices (Reis et al., 2018; Textile Exchange, 2020). Wool fibers can also be recycled into keratin hydrolysate, generated from the breakdown of wool fibers through an enzymatic treatment, which contains nutritional value; it can be reused for biofertilizers, animal feed, and the cosmetics industry (Navone et al., 2020). Most efforts in the wool market are collaborations between companies and mills, which offer transparency, pre-consumer waste wool fabric, and fibers to re-manufacture for sustainable fashion (Cattermole, 2018; Moorhouse, 2017). Despite success in sustainability, conventional wool still dominates the U.S. wool market at a 98% consumer usage while, sustainable and recycled wool is left at a 2% usage (Textile Exchange, 2020).

According to Feuz et al. (2018), the U.S. sheep inventory has fallen from 13 million in 1980 to 5.3 million in 2015; as wool is unable to keep up at the rate that synthetic fibers are being produced and sold. Farmers raise sheep breeds that are able to produce greater monetary value. Fine Wool (17.5-20 microns) has the largest market share in the global market due to the popularity of merino wool, which is commonly used in apparel products because of their softer and more comfortable feel next to the skin. As of 2020, the wool market equals roughly around 1% of the entire fiber market which is dominated by conventional wool. However, initiatives to support all sheep breeds have been developing. Programs with both animal welfare and responsible land use have offered the potential to create positive impacts for sheep breeding and animal welfare (Livestock Conservancy, 2020).

Consumer Research. Most consumers lack information regarding the process of wool production; nonetheless, as more information is provided, consumers may value claims which will lead to more consumption and value towards sustainable wool products (Peterson et al., 2012). The U.S. wool market has actively sought to develop products that appeal to ethically minded consumers by promoting natural and environmentally positive attributes of wool products (Sneddon et al., 2014). Several studies convey a segment of U.S. consumer interest towards purchasing fiber products made with animal fibers, such as wool, mohair, alpaca or cashmere, which undergo transparent and ethical practices, but have limited certifications (Hustvedt et al., 2008; Sneddon et al., 2014). There is a clear opportunity for the U.S. wool market to capitalize and take advantage of consumer preferences for sustainable wool. However, the production of wool within the U.S. market has been declining over time and in 2019 wool production faced a 2 percent decline from 2018. It is unable to keep up at the rate that synthetic fibers are being produced and sold, which has led farmers to focus on raising sheep for meat rather than wool (Pawson & Harvey, 2013; USDA, 2020).1 By attaching additional information on labels such as animal welfare concerns, consumers who value animal rights will act upon their

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1 US wool producers report difficulty in meeting the requirements of tailoring their cultivation to fit the organic needs of meat production, not that of fibers or textiles, in order to certify their herd and wool as organic under the guidelines of the National Organic Program (NOP), which fails to address the special industry of animal by-products. A study by Bernard et al. (2013) examined the nature of organic labeling within the U.S. wool market identified that by exploring alternative labeling that inform the consumer about sustainable concepts for wool, producers have more options in marketing their wool as "organic" without the required standards of meat production, which has been known to cause a rigorous method for creating "organic" wool.

values when purchasing a wool product thus, developing a sense of connection between the animal and products in hand due to alternative labeling (Hustvedt et al., 2008). By expanding consumers' knowledge of alternative labels and the production of wool fibers, producers can economically benefit and influence consumers' willingness to pay for wool products (Peterson et al., 2012).

Wool fiber is a strong candidate in creating a long-lasting and sustainable product that directly aligns with consumers' lifestyles and values, especially among consumers that have ethical concerns and preferences towards product development, production practices, and marketing of wool (Bernard et al., 2013; Hustvedt et al., 2008). In 2020, the U.S. wool fiber market has certified an additional 467 farms for the Responsible Wool Standards (RWS), which requires farmers to undergo sustainable and ethical practices, which aligns with consumer preferences and alternative labeling (Textile Exchange, 2020). A study by Sneddon et al. (2014) suggested consumers' hope for U.S. made, medium-priced, and independent designer labeled wool apparel, which is hard to find, but conveys the clear opportunity for the U.S. wool market to take advantage of consumer preferences for sustainable wool. Therefore, when creating a sustainable wool product, consumers value a combined label of pro-environment, animal-welfare, and origin of wool more than organic certification itself (Peterson et al., 2012). Nevertheless, the high value of wool can be emphasized through social, environmental, operational, and financial terms where organization-based communities, like the Responsible Wool Standard, can build upon collaborations, which enhance progress towards sustainability (Cattermole, 2018; Pawson & Harvey, 2013).

Several studies convey the potential value of labels for wool. This can be an effective marketing strategy for producers of animal-based fibers and apparel products, as consumers value a combined label of pro-environment, animal welfare, and origin of wool more than organic certification (Hustvedt et al., 2008; Peterson et al., 2012; Sneddon et al., 2014). When marketing sustainable products, there must be clear information that highlights what makes a product sustainable to a consumer as it may influence their willingness to pay (Henninger,2016). With marketing, co-creating slow fashion principles and a shared definition of sustainability can help strengthen a sense of a collective identity and improve consumer understanding (Ertekin & Atik, 2014).

Rare Sheep & Wool. A rising concern and focus on endangered "rare" sheep breeds has influenced the development of initiatives towards exploring markets and opportunities for the usage of rare wool fibers. To increase awareness for rare wool The Livestock Conservancy (2019), a non-profit organization, has created an initiative called "Shave 'Em to Save 'Em," to encourage and promote the usage of rare wool and conservation of heritage sheep breeds. When examining the feasibility of rare wool products, a study by Burks (2020) conveyed that rare wool was more suitable as a fashion embellishment rather than a next to skin product. Macramé, a decorative technique of creating textile using knots and hitches, was used to create a fashion embellishment with Leicester Longwool, an endangered/rare sheep breed. This wool was found to be the most feasible rare wool yarn for macramé design due to its loose twists and a higher consistency compared to other wool yarns. By exploring opportunities for rare wool, we can support farmers' economic development and explore consumer perceptions.

Digital Marketing of Fibers. Limited studies have evaluated digital marketing for natural fibers connected to fiber farms although several studies convey a segment of U.S. consumer interest towards purchasing fiber products made with animal fibers, which undergo transparent and ethical practices (Hustvedt et al., 2008; Sneddon et al., 2014). A study by Trejo and Lewis (2017) expressed that fiber farmers use social media to engage with a broader public. The farmers in the sample had sheep, goat, and alpaca farms in New York, Virginia, Illinois, and Texas. They posted photographs of their fiber animals and provided narratives that individualized them on social media. This prompted interest in physically visiting farms as part of fiber agro-tourism which can create a connection between a fiber product and the fiber animal on the farm. Although farmers may have also had fibers, clothing, or textiles to sell, this was not a major theme in the study, as the focus was more heavily placed on their animals, their characteristics that contributed to the farm environment, and opportunities for community engagement.

A study by Stannard (2020) evaluated fiber farmers' marketing strategies on 45 Etsy sites. The farms were primarily in the Midwest (33%), West (31%), Northeast (22%), and South (13%). In the "about" sections, farmers highlighted the state their farm was in, their farm's history, motivations for farming, and the idea of buying farm fresh to potential consumers. As part of farm history, subthemes included family heritage and narratives of their progression into farming. As part of motivations for farming, farmers conveyed a love of the farming lifestyle and efforts to be engaged with the community. There were 5 subthemes for buying farm fresh included in: product offerings (variety of fibers, natural colors, handspun yarns, etc.), local products (emphasis on state, use of local mills); ethical products (predator-friendly, chemical-free, etc.); heritage products (emphasis on uniqueness); education and outreach (messages to visit farm, meet sheep, etc.). This aligns with several ideas discussed as important by farmers (Trejo & Lewis, 2017).

As highlighted in both studies, it is necessary to explore the social relations between producers, consumers, and collaboration among all actors involved as the value of sustainable agricultural products is critically dependent on consumer awareness and perception (Ertekin & Atik, 2014). By attaching additional information related to the fiber animals and animal welfare, consumers may feel a sense of connection between the animal, the product listed, and consumers who value animal rights can act upon their values when searching for products (Peterson et al., 2012). Marketing and storytelling which express environmental integrity, animal welfare, social responsibility, sustainability, and transparency are also critical to the re-evaluation of sustainable products (Pawson & Harvey, 2013).

Methods

The objective of this research was accomplished by conducting a mixed-method research study that involves both quantitative and qualitative data collection. A three-part methodology was developed to explore creative opportunities for rare wool and consumer interest in sustainable fashion.

Part 1: Product Development

In order to explore potential opportunities for rare wool and expand consumer

knowledge towards heritage and endangered sheep breeds, this study used yarns from Leicester Longwool, a rare sheep breed. Rare wool has generally never received the same amount of attention and development as other wool fibers have, such as merino wool. However, this is because of the large fiber diameter that rare wool naturally contains, thus giving it a coarse texture and an unsuitable next-to-skin material when woven or knitted. In a recent study by Burks (2020), she examined the viability of rare wool as a macrame fashion embellishment rather than that of a next-to-skin garment. This study used the abstract design created by Burks (2020) to explore consumer perspectives regarding rare wool products with digital marketing.

Part 2: Digital Marketing

The second part of the study includes developing digital marketing of the rare wool fashion embellishment that aligns with several slow fashion ideals, especially localism and authenticity (Burks, 2020; Fletcher, 2008; Jung & Jin, 2014). This portion of the study involved evaluating digital marketing strategies of fiber farmers based on their farm or Etsy sites. Based on the focus on rare wool and the Livestock Conservancy "Shave 'em to Save 'em" initiative, the sites were also evaluated for whether they mentioned the Livestock Conservancy, SE2SE, or rare aspects of their sheep's wool. A total of 9 farm websites and Etsy sites were evaluated based on successful sourcing of rare wool from these farms in Fall 2019. The websites were analyzed in Fall 2020. The content analysis was conducted based on findings from Stannard's (2020) study. Although the sample size is small, it is considered a good representation of strategies taken by farmers who are participating in the Livestock Conservancy's SE2SE initiative. Originally 21 potential farms were identified for rare wool sourcing in the US; however, some farms sold out of materials by Fall or were non-responsive. The wool sourced from the farms and sites represents those farmers who were responsive and had a ready supply of wool in 2019.

The first step to create the digital marketing was to designate a product image for the ideations, which was an image of the abstract macrame design. The marketing conditions were created by using Adobe Illustrator. For the first marketing condition, we focused on the skilled craftsmanship of the product more than the general information of the product. The goal was to not overwhelm the public with too much information, but instead tailor the marketing ideation to the product itself. The second marketing ideation presents more information and aims to establish a connection between the rare sheep breed and the product. When fully composed, marketing ideation 2 aims to create an atmosphere that allows for the public to engage with a variety of aspects regarding both, the product and rare sheep breed.

Part 3: Pilot Consumer Survey

The third part of this study involved creating a pilot consumer study for quantitative and qualitative data collection. Consumer Orientation towards Slow Fashion (COSF), sense of empowerment, perceptions of digital marketing of the rare wool product, and demographics were evaluated (Jung & Jin, 2014; Sobreira, Moreira da Silva, & Romero, 2020). The target demographic for the pilot survey were U.S. consumers over the age of 18 years old. After obtaining IRB approval from the Cal Poly Pomona review board, the survey

was distributed to potential participants on Amazon Mechanical Turk. The online survey collected data from 39 participants in order to further evaluate consumer orientations, product-to-market adoptions for rare wool, and the use of select marketing attributes. The computer program Python was used to evaluate descriptive statistics, develop visuals, and analyze the reliability of the scales based on Cronbach Alpha values.[2] For open-ended responses, Dedoose qualitative software was used. Responses were coded based on the marketing ideation (1 or 2), a respondent was exposed to randomly, and whether responses were positive, neutral, or negative. The pilot study will inform future development of the survey in the full study with over 300 participants. Modifications will be made to survey questions, marketing ideations, and marketing as needed.
Results & Analysis

Part 1: Rare Wool Product Development

Part one of this study considers the slow fashion movement by exploring potential opportunities for rare wool with a macrame necklace created by Burks (2020). This can assist in evaluating the feasibility of the rare wool fibers and give insight into consumer perspectives regarding the rare wool product. Focusing on endangered/threatened sheep breeds, Burks (2020) initially cross-analyzed 3 sets of rare wool fibers (Florida Cracker, Dorset Horn, and Leicester Longwool) to identify the most feasible rare wool fiber and the potential to transform it into a product. Macramé, a decorative technique of creating textiles by using knots and hitches, was used to create a fashion embellishment in which a total of 3 fiber products were developed. By developing the embellishments and analyzing the fibers, Burks acknowledged the viability of Leicester Longwool yarns as the most effective rare wool fiber for an embellishment and recommended it for future research.

The product developed, a Longwool Macrame Necklace, is made from 100% rare wool and is composed entirely of a series of macramé techniques. Leicester Longwool yarns were sourced from a small-mid size U.S. Farm, Buckeye View Farm, located in Eggleston, Virginia. The farm aligns its ideals and practices with the broader fiber community, wool conservation, and economic development efforts based on the "Shave 'em to Save 'em" initiative. The Leicester Longwool fibers were identified to be the most feasible rare wool yarns for macramé designs due to the fiber's loose twist and higher consistency (Burks, 2020). These fiber properties prevent the overall composition of the product from curling up and creating discomfort; and thus, offers a soft and lustrous hand when new. Leicester Longwool, a threatened sheep breed, was historically a farm favorite during the 1800's however, it became less popular as merino wool and other conventional sheep breeds increased in popularity and monetary value (Livestock Conservancy, 2020). By the late 1930's, Leicester Longwool was likely to be extinct in the U.S.; however, the rarity of these sheep breeds has instead uplifted its value as their genes can be used in crossbreeding to create offspring with selective traits and unique clothing and textile products.

Part 2: Digital Marketing

In the analysis of digital marketing strategies among rare sheep and wool farmers in this sample, 55% of the wool farms had an Etsy site (5 farms), while 44% of the farms (4 farms) used a farm webpage to communicate information about their sheep and fiber products. Buckeye View Farm, the farm where Leicester Longwool yarns were sourced, had an Esty site designed for ecommerce that can reach a broad consumer market, compared to a regular website. Nonetheless, farmers took great pride in what they do, and they commonly use photographs of their sheep with product images to improve consumer perspectives regarding the wool process, which is consistent with previous research (Trejo & Lewis, 2017).

The theme of "buying farm fresh" was most prevalent among all of the farm sites evaluated, which aligns with Stannard's (2020) study (see Appendix A1 and A2 for more details). Such theme highlights the great value of heritage sheep breed, which were found in direct correlation with the product offerings, as the farmers commonly highlight the variety of their products (raw wool, roving, hand-spun, or mill spun yarn) and the heritage aspects of those products (rare sheep breed, natural wool colors) when listing/marketing. On the other hand, two farms highlighted the geographic State of their sheep farm, while 1 of 2 farms additionally emphasized the location of the local mill in which the wool was processed. Discussions about farm history and motivations for farming were limited other than indications of the year a farm was established. This differs from Stannard's (2020) study that found "farm history" and "motivations for farming" to be a prevalent theme of information to the consumer, which strengthens the farm brand or business. However, this may vary depending on how much information a farmer wants to share about their farm through their webpage or Etsy site. More importantly, 77% of farms evaluated highlighted the Livestock Conservancy or the SE2SE initiative on their sites, showing their commitment and dedication to bring greater awareness towards heritage/rare sheep breeds.

When further analyzing the farm websites, farmers also discussed animal welfare and sustainable land management strategies on their webpages, but rarely informed consumers on the product marketing or listing. Several studies convey the potential value of labels, which can act as a marketing strategy for producers as consumers value a combined label of pro-environment, animal welfare, and origin of wool more than organic certifications. Marketing attributes like environmental integrity, social responsibility, sustainability, and traceability can also play a critical role in re-evaluating wool fiber products and can help further engage the ideal of sustainability to the public. When marketing a sustainable wool product, utilizing combined labels of pro-environment, animal welfare, and origin of wool attributes can significantly influence the purchasing power of consumers who are acting upon such concern for animals. Therefore, by acknowledging such attributes, awareness, and information, a sense of connection can be made between the animal and the product in hand. Nonetheless, the information presented can sometimes be linked to an information overload where excessive information can cause consumers to feel overwhelmed and unable to act upon what is presented in front of them. However, is it that exact lack of knowledge and awareness towards sustainability that has led consumers in having a hard time grasping a holistic definition and perspective towards the real concept of sustainable production and consumption.

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[2] The following Python packages were used for data visualization and analysis: pandas, matplotlib, seaborn, and pingouin.

Since sustainability within the apparel industry is a producer and consumer engaged dilemma, it will require that exact engagement in order to advance the awareness and attraction towards sustainable, renewable fibers, and material use. Marketing Ideation 1, shown in Figure 1a, consists of very basic yet formal information that contributes to an indirect spectrum of marketing attributes. Basic information about the product like fiber-yarn content, country of origin, and design methods were included, but are not the main eye-catching aspect of the ideation. In front and center of the ideation is product image, to which the public would notice and intake the product first and the information second. Nonetheless, the overall composition of marketing ideation 1 sets the foundation for structure and space allowed for the second ideation. As shown in Figure 2a, Marketing Ideation 2 has similar attributes as ideation 1; however, we added logos (U.S., Livestock Conservancy) to engage the public further visually with a sense of environmental integrity and social responsibility. The goal of using logos was to help the public re-evaluate the wool fiber product and further engage the ideal of sustainability to consumers. The second marketing ideation consists of 2 images, 1 of the products and 1 of the farm's sheep. The information presented was split into 2 sections. The top section consists of information regarding the rare sheep breed while the bottom section includes the overall information about the product. When fully composed, marketing ideation 2 aims to create an atmosphere that allows for the public to engage with a variety of aspects regarding both, the product and rare sheep breed.

Figure 1a and 1b: Digital Marketing Conditions
Marketing Ideation One: *Marketing Ideation Two:*

Important Attributes
- Abstract Design Detail
- Country of Origin (COO)
- Heritage, Rare sheep breed and wool
- Mention Livestock conservancy – sheep endangerment
- Product Image
- Style Name

Important Attributes
- Abstract Design Detail
- Country of Origin
- Farmers' Heritage Sheep Image
- Features Three Logos
- Specific Heritage, Rare sheep breed and wool
- Mention Livestock conservancy – sheep endangerment
- Product Image
- State of Farm
- Style Name
- Type of Product Production (Hand-Made)

Part 3: Filot Consumer Survey

For the pilot consumer survey, the goal was to obtain 40 responses through Amazon Mechanical Turk and 39 participants successfully completed the survey within 2-hours of the survey being open. Regarding demographics, among the 39 participants, 24 were male respondents and 15 were female respondents. Approximately 67% of those who responded were 35 years old or older, while 33% were between the ages of 18 to 34 years old. Most participants, 85%, were of Caucasian descent, while only 15% were considered people of color or of two or more descents. The annual household income of the 39 participants was mainly in the range of $25,000-$100,000, which composed 79.5% of survey participants; 17.9% were making more than the mass annual range. One participant was found to be making less than the mass annual range of $25,000-100,000.
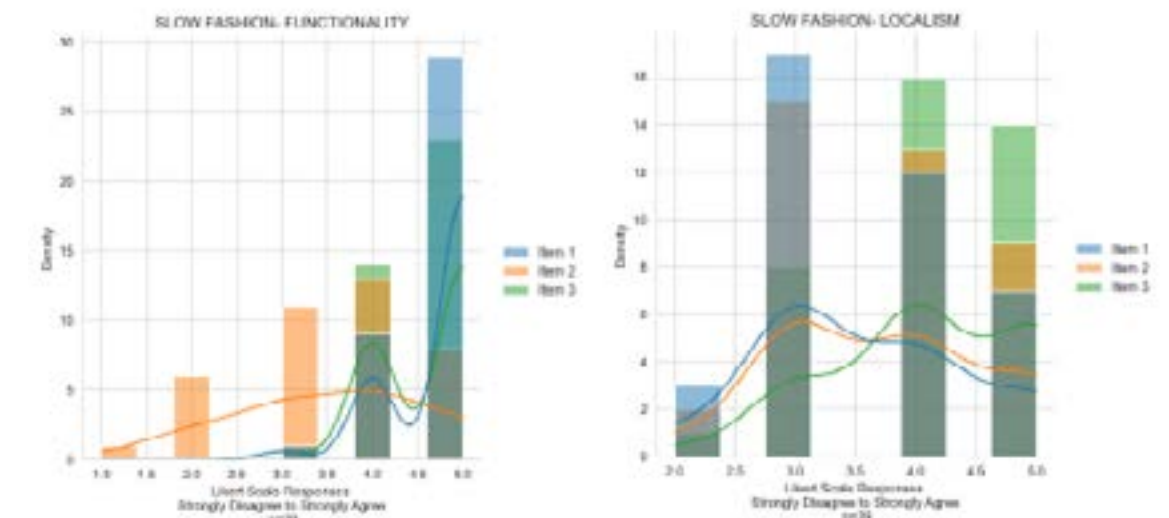
Consumer Orientation towards Slow Fashion

The first section of the survey asked question regarding COSF (Jung & Jin, 2014). Key questions were introduced to participants based on 3 general sub-headings (Production of Apparel, Utility of Apparel, Uniqueness of Apparel). The study provides underlying dimensions for consumer orientation towards slow fashion and identifies the five main values in question: equity, authenticity, functionality, localism, and exclusivity. The survey items listed below identify the exact statement and value that contributes to each 5-point Likert scale ranging from Strongly Disagree to Strongly Agree (See Appendix B for the survey items used).

The first section of COSF, Production of Apparel, examines consumer perceptions of Equity and Authenticity. Jung and Jin (2014) define Equity as involving producers who are fairly compensated, respected, and offer accessible fair-trade products. Authenticity is focused on skilled craftsmanship and use of traditional techniques to provide a historical narrative. Figure 2a and 2b conveys Kernel Density Estimation (KDE) graphs of participant responses for Equity and Authenticity survey items. After conducting the survey and reviewing results, consumer orientations towards Equity were found to be neutral to positive as most respondents mainly agreed with the statements presented to them ($\bar{x}$ =3.6, SD=0.2). When asked about Item 1 -fair compensation, about 59% of respondents agreed or strongly agreed on the importance (n=39). This implies that participants often look beyond the product and into the production of apparel, before purchasing. When asked about Item 2 -fair trade, 56% of respondents agreed or strongly agreed; thus, highlighting an underlying issue of awareness to the ethics of apparel production. When questioned about Item 3 -working conditions, 69% of respondents agreed or strongly agreed on the importance, which suggests that this needs to be clear to consumers when purchasing a product. For Authenticity, consumers responded more positively overall ($\bar{x}$ =4.1, SD=0.3). When evaluating authenticity, based on the Item -valuing clothes that are made by traditional techniques, 53% of respondents agreed or strongly agreed (n=39). The last two statements were received with greater awareness as 84% of respondents were in agreement with regards to preference for Item 2 -craftsmanship and Item 3 -hand-crafted clothes. Such results convey consumer orientation towards authenticity where participants understand the value of authenticity.

Figure 2a and 2b
Kernel Density Estimate Graphs for Slow Fashion Equity & Authenticity

Figure 3a and 3b
Kernel Density Estimate Graphs for Slow Fashion Functionality & Localism
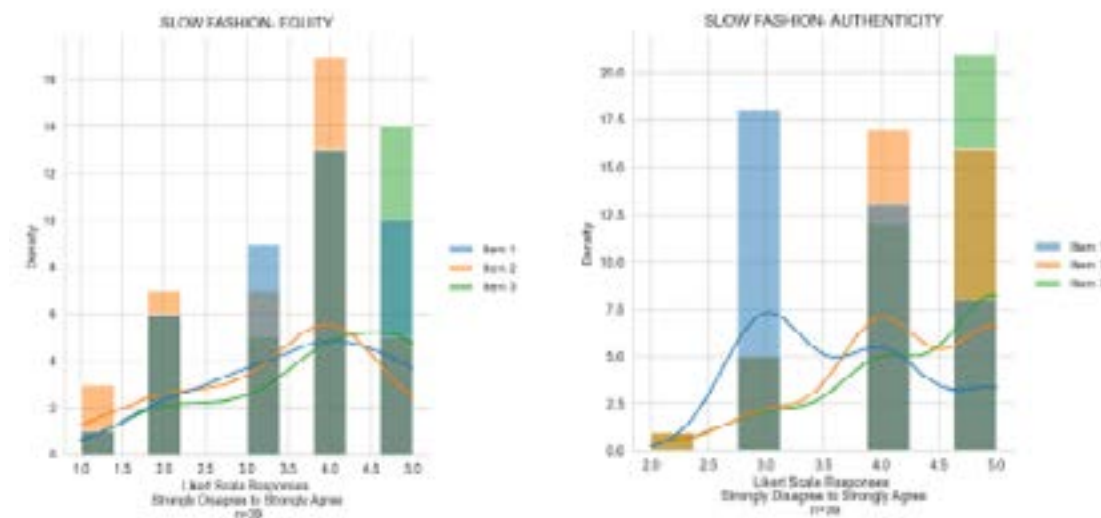
The second subject of COSF, Utility of Apparel, examines Functionality and Localism. Localism includes using local resources and supporting local or domestic businesses while Functionality is defined as the full use of a clothing item, including its longevity and versatility (Jung & Jin, 2014). When reviewing results, consumer orientations towards Functionality were positive ($\bar{x}$ =4.3, SD=0.6). Figure 3a and 3b presents KDE graphs of participant responses for Functionality and Localism survey items. Participants expressed strong agreement for Item 1 clothing longevity, 98%; as well as Item 3 – preference for simple and classic designs, 96% (n=39). In comparison, for Item 3 – wearing clothes in multiple ways, 54% agreed or strongly agreed. When questioned about Localism, respondents were more neutral ($\bar{x}$ =3.8, SD=0.3). For Item 1 – buying clothes made in the U.S. and Item 2 – belief of value for locally produced materials, participants agreed or strongly in a range of 49% to 54%. For Item 3 – supporting U.S. apparel brands, there was stronger agreement 77%. Such results suggest that consumers may be ambivalent towards clothes made in the U.S. or locally produced materials but tend to support U.S.-based brands. Therefore, when marketing a product, statements that embody locally made goods should be clear to consumers.

The last subject of COSF, Uniqueness of Apparel, evaluates Exclusivity. Exclusivity means offering unique items that have distinct, rare characteristics, and that are produced in small quantities. When reviewing results, potential consumer orientations towards exclusivity were not as large of an attribute for a product compared to the other subjects in this survey ($\bar{x}$ =2.6, SD=0.2). (see Appendix E1 for the KDE graph). Most respondents expressed disagreement towards Item 1 -limited edition items holding special appeal, Item 2 – being attracted to rare items, and Item 3 – enjoying the exclusivity; participants agreed at a rate of 25% to 31% (n=39). Such results suggest that consumers are unfulfilled with exclusivity unless combined with other values of Slow Fashion such as Localism or Authenticity.

Sense of Empowerment

The second section of the survey, Perspectives, was introduced to participants as general sub-headings (Empowerment, Power and Fruition, Encouragement) that fall within the section's theme. The goal of the overall section was to explore potential consumer attitudes to further evaluate the influence it has slow fashion and consumers, as discussed in a study by Sobreira, Moreira da Silva, and Romero (2020). The study found that attributes of empowerment positively influence COSF, to which the study identifies four main factors of empowerment: Self-Esteem-Self-Efficacy, Community Activism and Autonomy, Power-Powerlessness, and Optimism & Control over the Future. The survey items listed below identify the exact statement and value that contributes to each 5-point Likert scale ranging from Strongly Disagree to Strongly Agree (see Appendix C for the survey items used).

The first aspect of Empowerment examines the consumer attitudes towards Self-EsteemSelf-Efficacy. In a recent study by Sobreira, Moreira da Silva, and Romero (2020), they were able to acknowledge that self-esteem-self-efficacy had a positive impact on functionality, localism, equity, and authenticity dimensions of slow fashion.

When reviewing the results, consumer attitudes towards empowerment were neutral to positive as shown in Figure 4a (x̄ =3.9, SD=0.2). Among the 5 survey items, 64% to 74% expressed agreement regarding Self-Esteem-Self-Efficacy (positive attitude towards self, confidence, capability, etc.). The statement that received the most agreement was Item 4 -"When I make plans, I am almost certain to make them work," thus conveying determined and persistence of respondents' attitudes.

Figure 4a and 4b
Kernel Density Estimate Graphs for Empowerment Self-Esteem-Self Efficacy & Community Activism-Autonomy
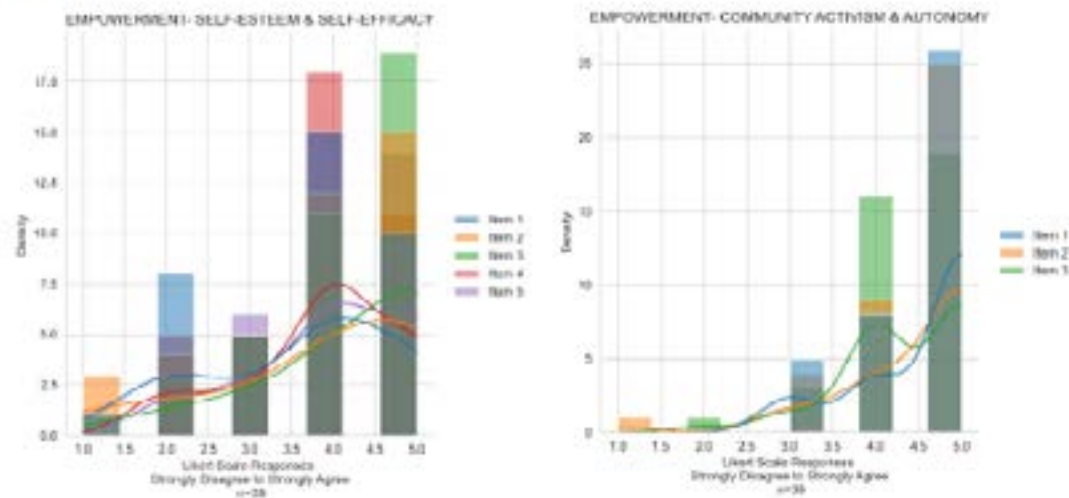
The second aspect of Empowerment examines consumer attitudes towards Community Activism/Autonomy and Power-Powerlessness. In Sobreira, Moreira da Silva, and Romero's (2020) study, power-powerlessness was found to have a negative significant effect on equity and functional factors while community activism and autonomy had a positive impact on authenticity, functionality, and localism. As shown in Figure 4b, the results of Likert scale show that consumer attitudes are in compliance with Community Activism/Autonomy, to which all three items were received with agreement between 87% to 89% (x̄ =4.45, SD=0, n=39). The survey items asked about perceptions of working together to have a community impact, power in a group, and taking action to solve a problem (n=39). In comparison, for Power-Powerlessness survey items, agreement was below 48% (x̄ =2.9, SD=0.5), which suggests some agreement towards trusting experts, ambivalence towards going along with the group, and disagreement that the government cannot be opposed (see Appendix E2 for the KDE graph). In Sobreira, Moreira da Silva, and Romero's (2020) study, both Items 2 and 3 were found to be negative attitudes toward slow fashion ideals, as most participants clearly disagreed with such statements made and believe that they have minimal power. On the other hand, participants acknowledged that experts or professionals are in the best position to enact change which for the most part is true, but when considering the apparel industry, professionals' impact may be limited. Overall, consumer attitudes toward Power-powerlessness were found to have a negative effect on furthering slow fashion ideals of consumers.

The last aspect of Empowerment examines attitudes towards Optimism and Control over the Future. In Sobreira, Moreira da Silva, and Romero's study (2020), factors such as happiness and optimism positively impacted the exclusivity factor of slow fashion.

The results of this study suggest neutral overall responses towards Optimism and Control over the Future (x̄ =3.7, SD=0.2). Likert scale responses show that consumer attitudes are most prevalent in a positive agreement towards all statements, especially for Item 4 -"Very often a problem can be solved by taking action" (see Appendix E3 for the KDE graph). Respondents agreed least, 33%, on Item 3 – optimism for the future, potentially due to the pandemic.

Further data analysis is necessary to evaluate relationships between the different variables such as Consumer Orientation Towards Slow Fashion and Empowerment. The overall results of the pilot study convey neutral to positive consumer perceptions towards slow fashion and neutral responses towards sense of Empowerment. Now more than ever, consumer attitudes are more open to suggestions that can positively impact their empowerment, which align with slow fashion and sustainability. Consumer orientations towards exclusivity were not as big of an attribute for a product compared to other dimensions discussed. Participants heavily agreed upon the idea of supporting U.S.-based brands combined with localism, equity, and authenticity values based on a previous study (Sobreira, Moreira da Silva, & Romero, 2020). Therefore, when marketing a product, statements or labels that embody values of slow fashion must be clear to the consumer when purchasing a product for them to act upon potential slow fashion values.

Reliability Analysis

To evaluate the reliability of the survey scales and pilot study results, we cross referenced 2 previous studies to examine the internal consistency by using Cronbach Alpha (Jung & Jin, 2016; Sobreira, Moreira da Silva, & Romero, 2020). Cronbach Alpha computes the correlation between responses to all the statements in 1 scale, to which we were able to check the consistency of data between the studies. For a scale to be considered internally consistent, an alpha of 0.70 or higher is desired although slightly below what is usually considered acceptable. Table 1 presents the comparison. When acknowledging our slow fashion study data and comparing our Cronbach alpha values to previous studies, Equity, Exclusivity, and Localism data was found to be similar with Cronbach α values of past research. However, when examining the data for Authenticity and Functionality, our Cronbach α values are lower than 0.70, thus acknowledging that the survey items for these dimensions were not as internally consistent. However, when the 2 data sets were compared with a previous study, the Cronbach α value of Authenticity aligns with past research values, while the Cronbach α value of Functionality is not. Such comparison implies that the dimension, Functionality, was not consistent in responses.

When acknowledging our Empowerment survey data, we cross referenced 1 similar study (Sobreira, Moreira da Silva, & Romero, 2020), that also evaluated consumer attitudes towards slow fashion for a test of reliability. Self-Esteem & Self-Efficacy was the only dimension found to align with such past study. On the contrary, our Community Activism & Autonomy and Optimism & Control over the Future dimensions were found to be internally consistency through our Cronbach α values but were not congruent with previous studies. Only 1 dimension from the Empowerment survey, Power-Powerlessness, was found to be inconsistent, thus implying an mis-intercorrelation within the statement. Overall, our data was internally consistent with Cronbach alpha values greater than 0.70.

Table 1
Cronbach Alpha of Slow Fashion Pilot Study and Previous Studies

Slow Fashion Pilot Study (n=39)	(Jung & Jin, 2016)	(Sobreira, Moreira da Silva, & Romero, 2020)
Equity – Cronbach α 0.937	0.876	0.774
Authenticity – Cronbach α 0.642	0.656	0.774
Functionality – Cronbach α 0.389	0.651	0.532
Localism – Cronbach α 0.817	0.740	0.787
Exclusivity – Cronbach α 0.903	0.836	0.870
Empowerment Pilot Study (n=39)		
Self-Esteem & Self-Efficacy – Cronbach α 0.937		0.843
Community Activism & Autonomy – Cronbach α 0.810		0.586
Power-Powerlessness – Cronbach α 0.163		0.509
Optimism & Control over the Future – Cronbach α 0.796		0.465

Digital Marketing Ideations

For the third section of the survey, one of the Digital Marketing ideations was randomly shown to participants. They either examined Marketing Ideation 1 (Indirect Spectrum) or Marketing Ideation 2 (Full Spectrum), which was created in Part 2 of this study. In evaluating participants' exposure to the different ideations, 41% of participants were exposed to Marketing Ideation 1, while 59% of participants were exposed to Marketing Ideation 2. They were then asked to acknowledge and examine the ideations for Marketing Relevance, Marketing Aesthetics, Marketing Information. The survey items listed below identify the exact value and statements that contributes to each 5-point Likert scale ranging from Strongly Disagree to Strongly Agree (see Appendix D for the survey items used).

When asked about Marketing Relevance, the consensus of participants was in agreement with all statements made ($\bar{x}$ =3.9, SD=0.2, see Appendix E4 for the KDE graph). The strongest in agreement was the relevance of animal well-being, 85%, as more people reviewed the full spectrum marketing ideation than that of the indirect spectrum, thus emphasizing the relationship between the rare wool sheep bred and product. The second highest in agreement was relevance to their own ideals/values, 69%, thus implying that consumer sentiment has increased due to the awareness of information or have already taken part in sustainable values. Participants also found the ideations to be relevant to both, information and sustainability as both ideations contained similar general information about the product and its composition. The least in agreement was the relevance to the product quality, to which participants liked the product but still wanted the product to be shown in greater detail. In considering marketing aesthetics, the overall consensus of participants believe that the aesthetics of the marketing ideations was a bit too much, to which they found the visually somewhat overwhelming. Nevertheless, the ideations were found to be easy to acknowledge and engage with, thus offering the correct, precise, and simple information regarding the product and sheep breed. Moreover, a neutral standpoint was found when asking if they would recommend such ideation.

Participants also provided opened responses to which they were asked questions about marketing appeal, information, and suggestions for improvements. A total of 133 open responses were gathered to which each response was either labeled as Positive, Negative, Or Neutral based on the marketing ideation (Indirect or Full Spectrum) presented .When looking over the responses for appeal, 31 were positive messages that concurred the aspects of the product, production of product, and the relationship between the rare wool sheep breed and product. The remaining messages, 8, were negative and expressed lack of appeal of the product itself. When asked about informative marketing aspects, 36 participants responded positively and expressed their awareness of information as being simple, easy to understand, and interesting to acknowledge. On the contrary, only 3 responses indicated lack of information. Finally, participants were asked about suggestions to further develop the ideations to which the majority of responses, 12, were neutral on suggestions. Four respondents suggested that the ideation should indicate a price tag, product profits related to sheep, and/or changes to the layout for the ideation. The rest of the participants, 23, has no further suggestions to offer for the marketing ideations.

Table 2 presents the breakdown of qualitative responses for each marketing ideation. A total of 54 responses were gathered for Marketing Ideation One; 8 responses were negative, 8 responses were neutral, and 38 response were positive. Marketing Ideation Two had a total of 79 responses to which 6 responses were negative, 18 responses were neutral, and 55 responses were positive. Overall, there were 14 negative responses, 26 responses were considered to be neutral, and 93 responses were positive thus giving us a total of 133 responses collected for both marketing ideations. All things considered, we were able to achieve more positive responses than that of negative ones, thus highlighting the validity of both ideations to consumers. Nonetheless, participants were found to be more intrigued and seem to enjoy Marketing Ideation Two more, which offered more information than Ideation One and had established a connect between the fiber product and animal well-being, as more positive results and fewer negative responses were achieve.

Table 2
The Breakdown of Qualitative Responses for Each Marketing Ideation

	Negative	Neutral	Positive	Total
Marketing Ideation One (Indirect Spectrum)	8	8	38	54
Marketing Ideation Two (Full Spectrum)	6	18	55	79
Total	14	26	93	133

Participants considered marketing ideations to lack visually calmness and aesthetic appeal. However, they found the ideations to be easy to read and able to acknowledge the information presented. As more traditional ethical attributes about the rare wool become more prevalent through marketing ideations, consumers will often look beyond the product and into the production of apparel before purchasing. Even so, ethical attributes are most important to consumers and their own ideals/values, thus implying that consumer sentiment can increase due to the awareness of information and ethical practices that partake in sustainable actions and production. The relevance of animal well-being is a very important marketing attribute, as such information presented can further enhance the relationship between the rare wool sheep breed and the product itself. Nonetheless, open-ended responses suggest that the ideation should contain a price tag, a better product image, and a change of layout for the design composition. Modifications should be made to marketing ideations for future consumer research regarding marketing attributes and rare wool products to fit consumers' needs and attention. Some revisions should include an on-person detail product shot of the rare wool product, a new layout for the ideation that is not visually overwhelming.

Conclusions

Sustainability has encouraged many new perspectives in fashion; however, as awareness grows, industry efforts must emerge and meet the outspoken challenges of the fashion system by implementing new strategies that integrate environmental and ethical benefits. By increasing consumer knowledge of the production of wool, producers can economically benefit. The local, farm connection may influence the consumers' willingness to pay for wool products; however, more research is needed in this area. Such attributes during wool marketing campaigns can further a natural fiber shift as sustainable actions mainly occur when information is acted upon. Product marketing is where consumers can learn about a product, evaluate it more critically, and can understand its origins. Ultimately, the most crucial piece of information should be placed on product marketing to advance consumers' understanding of the product. Therefore, sustainability and marketing ideations go hand in hand as both forms of consumer communication and connections are critical in the 21st century. Future research should focus on a specific demographic of sustainable consumers rather than the broader public, as sustainability is still relatively a small niche market. Consumers who have high orientation towards sustainability or slow fashion can be further studied to provide more data in this niche field. Future research can consider consumer economic sentiments based on the negative impacts of the pandemic.

Acknowledgements

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Appendix A1

Comparison of Major Fiber Farm Major Themes with Rare Wool

Major Themes	Southdown (Farm website)	Jacob (Etsy site)	Black Welsh Mountain	Cotswold (Farm website)	Gulf Coast (Etsy site)	Karakul (Farm website)	Dorset Horn (Etsy site)	Florida Cracker (Etsy site)	Leicester Longwool
			(Farm website)						(Etsy site)
Farm history		Year farm began 1979		Year farm began 1990	US small farm heritage		Year farm began 2007		
Motivations for farming						Community engagement – teaching others about sheep			
Buying farm fresh	Product offerings, Heritage products	Product offerings	Product offerings, Heritage products	Product offerings, Heritage products	Product offerings, Heritage product s, Local product s (state, local mill)	Product offerings, Heritage, Local products (state)	Product offerings, Heritage products	Product offerings, Heritage products	Product offerings
Mention of Livestock Conservancy	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix A2

Developed based on Stannard (2020)

Rare Wool	Website Evaluated
Southdown	http://thesassyewe.blogspot.com/
Jacob	https://www.etsy.com/shop/HavencroftFarm
Black Welsh Mt	http://desertweyr.com
Cotswold	https://www.nistockfarms.com/
Gulf Coast	https://www.etsy.com/shop/HFAFarmstead14?ref=simple-shop-header-name&listing_id=665654302
Karakul	https://aniroonzsheepcompany.bigcartel.com/
Dorset Horn	https://www.etsy.com/shop/CoveredBridgeFiber?ref=nla_listing_details
Florida Cracker	https://www.etsy.com/shop/SilverBulletFarmLLC
Leicester Longwool	https://www.etsy.com/shop/GypsyMountainFarm?ref=nla_listing_details

Appendix B

Consumer Orientation towards Slow Fashion Survey Items (from Jung & Jin, 2014)

Production of Apparel

Equity

Fair compensation for apparel producers is important to me when I buy clothes.

I am concerned about fair trade when I buy clothes.

I am concerned about the working conditions of producers when I buy clothes.

Authenticity

I value clothes made by traditional techniques.

Craftsmanship is very important in clothes.

Handcrafted clothes are more valuable than mass-produced ones.

Utility of Apparel

Functionality

I tend to keep clothes as long as possible rather than discarding quickly.

I often enjoy wearing the same clothes in multiple ways.

I prefer simple and classic designs.

Localism

I prefer buying clothes made in the U.S. to clothes manufactured overseas.

I believe clothes made of locally produced materials are more valuable.

We need to support U.S. apparel brands.

Uniqueness of Apparel

Exclusivity

Limited editions hold special appeal for me.

I am very attracted to rare apparel items.

I enjoy having clothes that others do not have.

Appendix C

Survey Items Sense of Empowerment (from Sobreira, Moreira da Silva, & Romero, 2020)

Empowerment

Self-Esteem-Self-Efficacy

I have a positive attitude about myself

I am usually confident about the decisions I make

I see myself as a capable person

When I make plans, I am almost certain to make them work

I generally accomplish what I set out to do

Power and Fruition

Community Activism and Autonomy

People working together can have an effect on their community

People have more power if they join together as a group

Very often a problem can be solved by taking action

Power-Powerlessness

Experts are in the best position to decide what people should do or learn

When I am unsure about something, I usually go along with the group

You cannot fight government

Encouragement

Optimism & Control over the Future

People are limited only by what they think possible

I can pretty much determine what will happen in my life

I am generally optimistic about the future

Very often a problem can be solved by taking action

Appendix D

Survey Items Marketing Condition (developed by author)
Marketing Relevance
Relevant to Sustainability.

Relevant to Animal Well-Being.
Relevant to my own ideals/Values
Relevant to Information.
Relevant to Product Quality.
Marketing Aesthetics
Find most appealing.
Easiest to acknowledge and engage with.
Visually overwhelming.
I would recommend.
Marketing Information
It has enough information about the product.
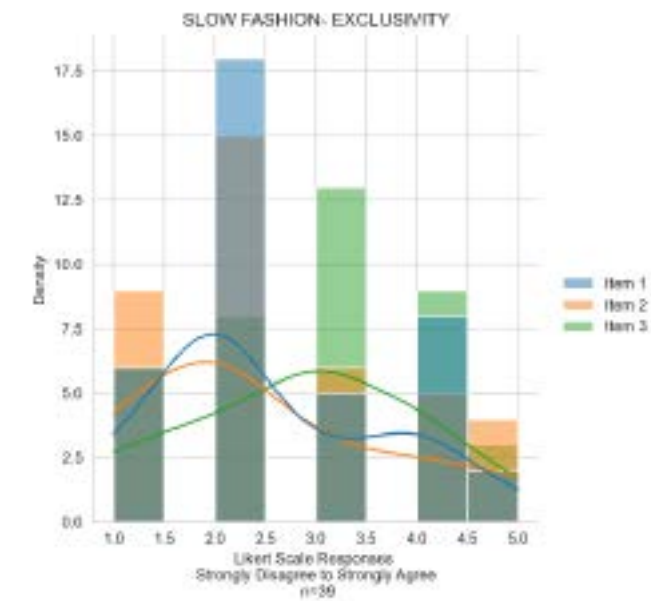Wish there was more information.
Lacks information to comprehend product.
Overwhelmed with Information
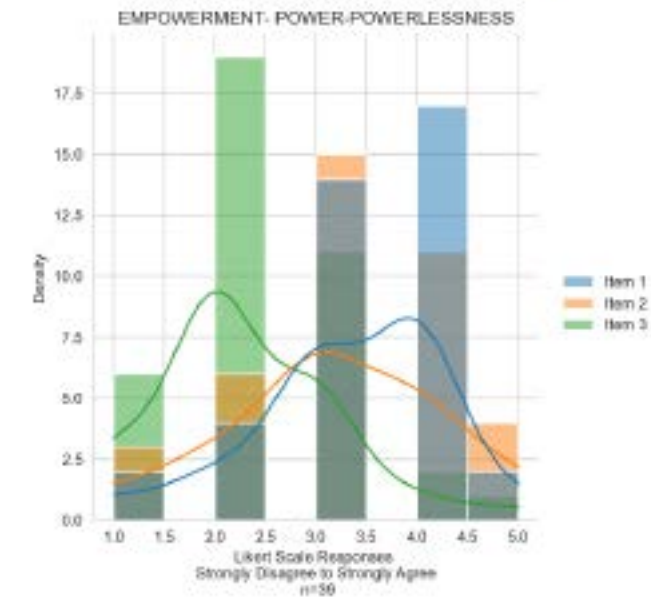Information is clear and simple

Appendix E1
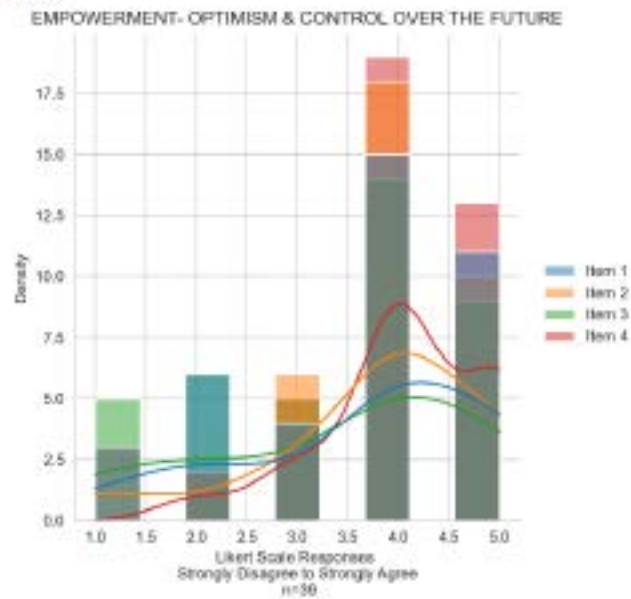*Kernel Density Estimate Graph for Slow Fashion Exclusivity Survey Items*

Appendix E2
Kernel Density Estimate Graph for Empowerment Power-Powerless Survey Items
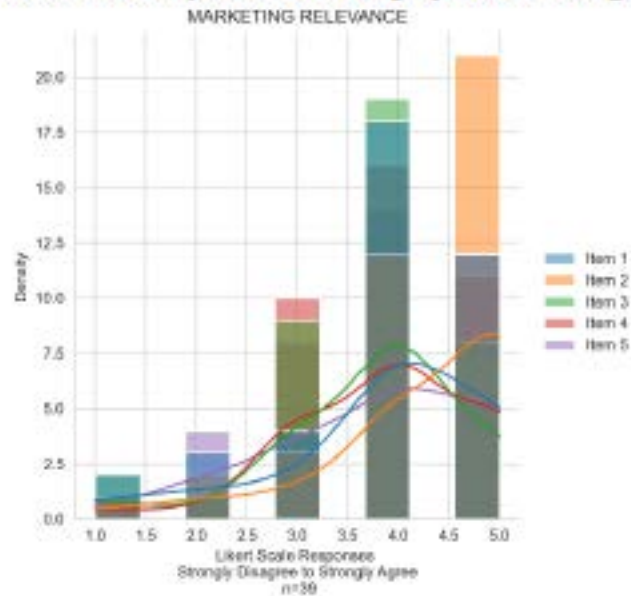
Appendix E3

Kernel Density Estimate Graph for Empowerment Optimism-Control over the Future Survey Items

Appendix E4

Kernel Density Estimate Graph for Marketing Relevance Survey Items

Velazquez
Luis

Gentrification and Creative Placemaking: Analysis of Methods by Which Low-Income Communities Can Redesign Themselves to Minimize The Possibility of Displacement

Abstract

Gentrification is an ongoing issue in many cities within the United States. For long low-income communities have been pushed out by gentrification. While gentrification increases the value of properties in disinvested communities, it results in increased rents and property values, leading to displacement in low-income communities. This challenge discourages communities from pursuing economic development within their communities. This paper examines how creative placemaking can be utilized to mitigate the negative effects of gentrification. Primary data was collected in five semi-structured expert interviews with planners, artists, activists, and non-profits from various jurisdictions in LA County using primarily qualitative methods. Contrary to prior research, creative placemaking alone cannot combat gentrification and displacement. The research findings suggest that placemaking is a tool for combating gentrification combined with other tools such as affordable housing, community engagement, and cross-sector partnerships.

Introduction

Concern over gentrification has grown in low-income communities throughout the Los Angeles region. Gentrification has caused a shift in demographics in many cities within the United States. There is the belief that revitalization leads to displacement in low-income communities. For long communities have been driven out by economic-driven development. While gentrification increases property values in disinvested communities, it results in increased rents and property values. This challenge discourages communities from pursuing economic development.

Creative placemaking projects can bring people together and can inspire people to explore their creativity. Creative placemaking can address political, social, economic, and cultural issues while also bringing investment to disinvested communities. The question remains, can creative placemaking mitigate the adverse effects of gentrification?

The reason for choosing this topic is to understand gentrification better and find ways to mitigate its effects on low-income communities. The analysis will consist of qualitative research. Instead of looking into creative placemaking projects, this project looked into how professionals see creative placemaking and its potential to deter displacement. This study will be necessary to planning because it will guide policymakers in decision-making when dealing with economic development and help their residents shape cities. Overall, it will ultimately benefit communities that consist of low-income and minority residents. This paper will explore solutions to allow communities to shape themselves through design.

Literature review

The growing role of public participation in planning has set a stage for creative placemaking. Creative placemaking finds a connection to traditional urban planning and city development and goes further. Several challenges arise through creative placemaking, such as the involvement of low-income people and the high possibility of gentrification. The reality is that revitalization projects in the process have transformed neighborhoods and displaced residents. (Lee, Slater, Wyly 2008) This literature review examines how gentrification can be mitigated through community engagement and design practices.

What is Gentrification?

Gentrification, first coined by Ruth Glass (1964) to describe the influx of gentry to a lower-income neighborhood in London from the 1950s to the 1960s, has become one of the most graphic indicators of the rapid transformation in cities across the United States. The definition of gentrification has varied across many city officials, urban planners, and researchers. The author of Missing Marcuse on gentrification and displacement defines it as "the transformation of a working-class or vacant area of the city into middle-class residential and/or commercial use" (Slater, 2009). Whereas in gentrification and displacement: a review of approaches and findings in the literature, gentrification is defined as "the in-migration of affluent households to poorer and lower value areas of the city" (Attkinson & Wulff, 2009). The purpose of this research, gentrification will be defined as a form of neighborhood change that occurs when higher-income groups move into low-income areas, potentially altering the cultural and financial landscape of the original neighborhood. (U.S Dept of Housing and Urban Development) Currently, millions of high-income families generate intense competition for housing, especially in more central urban regions (Lee, Slater, Wyly 2008; Dragan, Ingrid, and Sherry, 2019; González-Pampillón et al., 2020). Gentrification has been attributed to several causes, including political interests. A study by Grodach, Nicole, and James (2016) found out that art organizations are attracted to gentrified areas, although art does not create them. To understand gentrification, one must understand the historical circumstances underlying the problem, such as policies and practices that rendered neighborhoods vulnerable to gentrification. The idea of redlining comes up often when discussing gentrification. Redlining is a phenomenon that began in the 1930s and continued until the late 1960s, under a series of federal government guidelines that banks later implemented. As a result of this practice, various communities populated mainly by people of color were transformed and labeled as "risky" and "unfit for investment." Since redlined areas were openly refused development opportunities, those neighborhoods and residents fell behind other communities, where businesses, schools, and housing, including property

values, rose. Even though redlining as a practice has been prohibited since the enactment of the Fair Housing Act in 1968, the accumulation of suppressed growth has left populations of color feeling the consequences even today. According to a study by the National Community Reinvestment Coalition, 74% of the redlined communities in the 1930s are now low-to-moderate income, and 64% are majority-minority neighborhoods. (Mitchell 2018) Urban renewal was another historical condition that left neighborhoods vulnerable to gentrification. Low-income families and communities of color were left behind in central city areas, bearing the brunt of highway system growth and urban redevelopment efforts, which culminated in the widespread clearance of houses, industries, and neighborhood structures. They set the stage for the massive public and private disinvestment in the decades that followed. Segregation, mass de-urbanization of American cities, lack of social organization, and psychological trauma were all consequences resulting from urban renewal (Fullilove, 2001). Today, many residents and investors are returning to these disinvested communities because of their affordability, older historic housing stock, access to city centers, and revitalization initiatives.

While gentrification-motivated shifts have some positive implications, recent studies have shown that increased gentrification presents several significant challenges to low-income households across the United States (King and Jeffrey 2018). For example, in a study to determine the impacts of gentrification on low-income children, Dragan, Ingrid, and Sherry (2019) found that the process results in the displacement of thousands of families and upsets their lives. Also, contrary to traditional knowledge, low-income households that move from gentrifying communities settled in neighborhoods with similar poverty levels (Dragan, Ingrid, and Sherry, 2019). Similar results have been reported by many other scholars (Atkinson et al., 2011; Turan, 2018; Thurber and Janine, 2019). Dramatic changes associated with gentrification, such as rapid rise in rent, directly impact the living conditions of low-income households. With evidence indicating the adverse effects of gentrification, the need to find solutions to the challenges is for the benefit of groups that are negatively impacted is unavoidable.

Several studies have been conducted in an attempt to determine the best approaches for policymakers to respond to the severe effects of gentrification on local populations. These studies have presented many recommendations, including creating a strategic plan for Affordable Housing to provide alternative cheaper housing options to low-income households during gentrification (Atkinson et al., 2011). Generally, when a city or an area of a city occupied by low-income families is gentrifying, property values often increase (Thurber and Janine, 2019). Such increases often lead to a general rise in rent rates, making housing resources unattainable to these groups. As Atkinson et al. (2011) documented, poor households often respond by migrating to neighborhoods with potentially low or affordable rent rates.

A wide range of existing literature suggests that an affordable housing strategy could help policymakers solve the displacement challenge. According to Atkinson et al. (2011), the Affordable Housing Strategy in Marrickville, New South Wales, has proved effective in allowing local and federal governments to influence the housing market at local levels via the provision of inexpensive housing options for low-income households impacted by gentrification. Linker, Chris, and Christine (2001) suggested that an affordable housing plan

can be initiated by pursuing voluntary planning agreements with developers. The use of incentives can inspire developers to offer affordable housing to low-income households in development areas during gentrification.

Levy, Jennifer, and Sandra (2006) recommend various strategies the government can use to keep the neighborhood affordable. Their discussion covers approaches such as inclusionary zoning, housing trust fund, tax increment financing, and low-income housing tax credit. This idea is reinforced by Linker et al. (2001), who favors a housing trust fund method, noting that it enables local governments to rehabilitate or develop affordable housing moderate- and low-income individuals by assigning a public agency to collect and distribute financial resources, including penalties for delinquent real estate exercise taxes, accumulated interest from real estate transactions, and real estate transfer taxes for purposes of keeping rents affordable.

Community Mobilization and Involvement

Besides the mentioned policies, other studies have underscored the significances of community mobilization in countering the negative effects of gentrification. Among scholars who have supported this idea are Manzo and Perkins (2006), King and Jeffrey (2018), and Fraser et al. (2004). In their article, King and Jeffrey (2018) argued that the first step to achieving an equitable outcome in a weak community development city is mobilization. The findings of their case study about the gentrifying neighborhood in Northern Third Ward in Houston highlight the need for residents to support a collective action by stakeholders to discuss the effects of gentrification. This strategy in Third Ward, Houston, worked because a non-profit collective agency known as Emancipation Economic Development Council (EEDC) was created to bring together different stakeholders to discuss the survival of the area's low-income groups during rapid gentrification.

Martin (2007), Manzo and Perkins (2006), Fraser et al. (2004), and Levy and Roman (1980) agree with King and Jeffrey (2018), adding that community mobilization is an effective tool for countering political displacement. In their 1980 article, Levy and Roman (1980) argue that gentrifying communities tend to shift from long-time residents to new residents. Fraser et al. (2004) and Levy and Roman (1980) define this shift as political displacement. Long-time city residents are often active in their neighborhoods via participating in communal and social organizations such as block clubs, local churches, and civic organizations.

However, when a political displacement occurs, these residents lose active political leadership and control over their neighborhood as long-time residents become outnumbered or outvoted by the emerging new class of residents who rapidly dominate the city during gentrification (Martin, 2007). Consequently, long-time residents may feel excluded from speaking and organizing the community as their interests are no longer considered in determining the neighborhood organization (Martin, 2007). Through community mobilization, these groups of residents may gain sufficient political, social, and economic power to resist the negative impacts of gentrification and reclaim the lost community identity.

Other researchers (Turan, 2018; Sheppard, 2012), however, have proposed the

promotion of local participation as a means of restoring socio-economic equity in a gentrifying neighborhood. Turan (2018) argued that local participation could support the exchange of information between affected groups and decision-makers. This approach creates an opportunity for neighborhood planners to understand residents' views of gentrification (Turan, 2018). Grodach, Nicole, and James (2014) support that community organization approaches to intervening in gentrifying neighborhoods are essential in engaging research tools to inform social action. Therefore, according to Turan (2018), community or local participation could deliver benefits to low-income families with a higher likelihood of being displaced or negatively impacted by urban enhancement.

Sheppard (2012), on the other hand, proposed the formation of community coalitions and neighborhood & block associations to inspire local participation. He argues that community coalitions could improve the overall quality of life for economically disadvantaged citizens by uplifting residents' participation in local policy issues (Sheppard, 2012). Sheppard further considers neighborhood and block associations, which consist of residents of a particular neighborhood or community, a critical tool for enhancing conditions and alleviating potential shortages in gentrifying communities.

Creative Placemaking

Across the country, there have been a plethora of studies on different cultural strategies. Many cities have recognized the need to differentiate themselves to compete with other urban cities through the use of creative design and cultural projects and structures to provide a comparative advantage. (Zukin 1995) Projects have included stadiums, festivals, entertainment districts, and marketplaces. Critics have argued that the cultural economy idea leads to the regeneration of cities into more commercial spaces that only encourage tourists and result in increased poverty, gentrification, displacement, and the removal of character and authenticity from the neighborhood. (Zukin 2005) Thurber and Janine (2019), Markusen and Gadwa (2010), and Semi (2011) emphasize the use of creative policy-making interventions to inspire individuals and collective developments.

Semi (2011) outlines that a place-making approach could enable decision-makers to capitalize on community assets while inspiring and supporting resident's quality lives during city upscaling. Creative placemaking Similar, Thurber and Janine (2019) and Markusen and Gadwa (2010) note that creative policy-making interventions such as community stakeholders, engaging artists, researchers, and mobilizing residents may reduce the rate of gentrifying places, thereby helping local communities to cope up with changes by restorative place-based actions. Similar findings are presented by Frenette (2017) and Hecht (2014), who determined that creative place-making addresses issues of inequality and increases the role of artists in society while creating opportunities for minorities and addressing their needs without displacement. Hecht (2014) outlines explicitly that creative place-making in low-income communities can reveal and support creativity within a community. According to Markusen and Gadwa (2010), creative placemaking initiatives can result in more work, revenue, and resources being brought into societies. The desire for a single performing arts venue or gallery in this modern age is no longer there. Jackson, Herranz, and Green (2003) presented a comprehensive and informative guide for capturing the values of arts and culture based on four guiding principles. These guiding principles help define the various

aspects of a neighborhood's art, culture, and creativity.

1. Definitions of art, culture, and creativity depend on cultural values, preferences, and realities of residents and stakeholders in any given community.
2. Participation includes a wide array of ways people engage in arts, culture, and creative expression.
3. Arts, culture, and creative expression are infused with multiple meanings and purposes simultaneously.
4. Opportunities for participation in arts, culture, and creative endeavors often rely on both arts-specific and non-arts-specific resources.

Creative placemaking is on the rise thanks to the National Endowment of the Arts. In 2011 the NEA created the Our Town grant for non-profit organizations to take on creative placemaking projects. NEA provides project-based grants to programs that incorporate arts, culture, and architecture practices with strategies to improve communities by advancing local economic, physical, and social outcomes. Successful Our Town programs ultimately establish the groundwork for systemic changes that sustain the incorporation of arts, music, and architecture into urban community-building initiatives. These projects require a partnership between a local government entity and a non-profit organization, one of which must be a cultural organization. They should engage in partnership with other sectors such as agriculture and food, economic development, education and youth, environment and energy, health, housing, public safety, transportation, and workforce development. (NEA 2019) In developing the Our Town grant, one of the most significant proven achievements in creative placemaking was identified to be the use of these programs as tools for tackling neighborhood issues and influencing how arts, entertainment, and architecture policies are perceived as agents of change in urban planning, and policy-making.

Reviewing the literature leads back to the question: how can design mitigate gentrification in low-come communities? Analyzing both community involvement and placemaking is essential to furthering the conversation that design can decelerate the gentrification process and allow low-income communities to combat the effects and consequences of gentrification.

Methodology

I conducted interviews with experts within the Urban Planning field and professionals within the non-profit field, especially those working in creative placemaking. I conducted semi-structured interviews to allow more of a conversion. Due to the nature of the pandemic, I used online video conferencing, emails, and phone calls to conduct the interviews. The time and subject of the interviews were agreed upon via email. I interviewed five different individuals within different jurisdictions in Los Angeles County, and all agreed to a formal transcription of the interview. The five interviewees were:
• Miranda Sheffield | Community Activist & Cultural Arts Commissioner | City of Pomona
• John Carver | Planning Director | City of Paramount
• John King | Assistant Director | City of Paramount
• Mayra Villegas |Artist | City of Pomona
• Daily Leon | Director of Business Development | Latinas Art Foundation

All interviews were focused on the role of the planner, the role of non-profits, and the role of artists in combating gentrification and displacement in low-income communities. Afterward, the conversation shifted to how placemaking can help or add to gentrification and displacement. Each interview was organized around the sector that each individual specialized in and their experiences with creative placemaking. Each interview was organized around these common questions:

1. What is the planner's/activist's/non-profit role in helping combat the effects of gentrification?
2. Do you believe that non-profits and art organizations play a role in combating gentrification and displacement?
3. What are some strategies that you know of to combat gentrification?
4. How can cities/non-profits work to invest in low-income communities and bring investment and economic development to support these communities, local business owners, and artists without further contributing to the displacement and gentrification of these neighborhoods?
5. What placemaking initiatives have you been associated with?
6. Do you believe placemaking and art can be used to combat the effects of gentrification?

Using the answers to the interview questions, a thematic analysis was used to find correlations and shared values between all interviews. The analysis involved transcribing interviews and finding meaningful data by using a coding program.

Limitations

Due to the nature of pandemic, only five participants were able to be interviewed within Los Angeles County due to time conflicts and availability. Additional participants were contacted through email, but responses were not received. Due to time constraints, I was to move forward with my research with only five participants. Given more time, additional participants could be contacted to further this research.

Findings and Data Analysis

Miranda Sheffield: Community Activist & Cultural Arts Commissioner | City of Pomona

My conversation with Cultural Arts Commissioner Miranda Sheffield started with a short introduction of herself. She told me that placemaking was not her area of expertise. Still, after recently becoming the Cultural Art Commissioner, she wanted to utilize her role to be more progressive and address some of the more significant issues. Sheffield is an activist in the City of Pomona and has tried to politicize the issue of gentrification and how it is rooted. She emphasized that because we have black and Brown faces coming as developers into our cities, it does not necessarily mean that it is a good thing. She states that leaders and people within the city recognize displacement and gentrification as an issue but attracting businesses will always be on top of the agenda. When asked how the arts could play a role in combating gentrification and displacement, Sheffield stated that it is not necessarily happening within her community. Some organizations are making an active

connection between art and gentrification would be very difficult to answer that question at that moment.

She went on to ask me directly how I perceived or defined place-making. I described it to her as a way to inspire individuals and collective developments to bring people together So that decision-makers can capitalize on community assets while also encouraging and supporting resident lines during upscaling. I emphasized how creative placemaking must be a bottom-up approach versus a top-down approach, and she reacted by saying that she saw placemaking as this idea of changing outwards. Sheffield's comment made me understand that placemaking is not well-defined or well known in low-income or minority communities. Sheffield stated that she does not like the outsider approach, meaning always seeking out businesses like Amazon or Starbucks to gain economic profits in their community. The concept of creative placemaking as a way to combat gentrification was reasonably new to Sheffield by was intrigued by everything we spoke about.

When asked about the city's role in combating gentrification and displacement, Sheffield stated that it comes down to affordable housing. The lack of affordable housing and many cities lead to people being priced out, and gentrification only adds to the affordability issue. Communities might feel discouraged to pursue placemaking if there is not enough affordable housing, and suddenly there is an uprise in art installations or murals. She emphasized that she is a big advocate of community land trusts and that one thing that Pomona is missing.

John Carver: Planning Director & John King: Assistant Director | City of Paramount

It was crucial for me to get the perspective of a city planner to gain understanding and insight on the subject of displacement and gentrification. I had the luck of interviewing two individuals from the Paramount planning division: John Carver, Planning Director, and John King, Assistant Director. We started our conversation on their views and the city's view on placemaking, and how it contributes to gentrification. Carver began the discussion by stating that placemaking in any form could lead to excellent amenities such as bike lanes but, in the long run, could lead to adverse effects which negate the benefits of a beautiful amenity. Making a place so attractive might lead to displacement issues, ultimately causing the original task to be unhelpful. King compared it to Los Angeles and San Francisco by stating that these places to a life of their own.

Our conversation led to what the City of Paramount is doing right in terms of what cities can do better to combat gentrification. Carver stated that the city had done a great job establishing relationships with the school district, businesses, and non-profit organizations. Paramount has partnered with the school district to create programming, fund scholarships, and share facilities. He led to state that in terms of arts, there must be support between organizations. For example, in the city of Paramount, they recognize students for achievement s in art and honor them at local city council meetings.

I then questioned both on how placemaking can bring economic opportunities to low-income communities without displacement. They both said that the first barriers would need to be broken. King discussed the barrier of affordable housing that might discourage

placemaking within the city. Within the last decade, the city of Paramount has been able to balance affordable housing, which allowed for the development of programs. Placemaking can not work without a balance of housing and community involvement. Both Carver and King believe that cities should incorporate and support creative placemaking initiatives. The city of Paramount started a development fee in the 90s that asses a 1% art fee that led to an increase in local artist participation in the town and sculpture art the city took that time to capture the captive audience to ask the community about concerning issues.

Mayra Villegas |Artist | City of Pomona

I had the pleasure of reaching out to Mayra Villegas, a local artist in the City of Pomona. The conversation with Villegas was made through messaging and email due to conflicts in time. I sent her a list of questions for her to answer through email. She expressed that art can be beneficial in communities of low-income people. She states that the lack of art programs robs the young and old of critical education, creative outlets, and even personal growth. The issue with this is how we can build programs that help communities grow without the negative effects of gentrification. She spoke about the general issues in Boyle Heights and how they are combating gentrification. Art galleries moved into this area due to the low price of the area. Unfortunately, these "blue chip" galleries, high-end art, end up profiting and giving nothing back to the original community.

She states that to combat displacement and gentrification involves the actual community and not resort to high-end art but local art and culture. Villegas explains people, community, their housing situation, and their contributions to their community. "Adding art programs, non-profit galleries, hiring or inviting artists dedicated to the cause--all this will only reinforce the community, giving developers and other When asked about the role of planners in closing the gap in community engagement, both Carver and King stated that participation is vital within cities. One thing they are doing right is involving the community through social media and local events. With the use of social media, the city has been able to pump up advertisements for local meetings and has been very successful than other projects compared to the last ten years. King described city meetings to be dull and unattractive to constituents. Meetings are not a place an individual wants to be after a long day at work. Planners must find innovative ways to engage communities, such as bringing the meeting to them. The city of Paramount organized a mobile tour to go out to the community and brought the meeting to them. Before Covid-19, the town held concerts in the park, and bystanders crucial evidence that citizens are self-sufficient, strong, economically viable." (Villegas 2021)

Placemaking can be in part a solution to gentrification, but many factors are in play. As an artist, Villegas believes art plays a significant role in low-income communities, but art must come from within. Culture and art can serve as a voice to low-income communities such as Boyle Heights' Mexican American culture. The prominent culture in this community serves as a tool of sufficiency and how a community can come together to combat gentrification. Community togetherness is critical in the process of fighting against gentrification. Villegas states that placemaking alone cannot mitigate the effects of gentrification but can be used as a method such as the power of community closeness. She says that cities can only give communities the resources to grow from within and cannot

impose an idea upon them.

Daily Leon | Director of Business Development | Latinas Art Foundation

Daily Leon, the development director for the Latinas Art Foundation, has been involved with many special events within several low-income communities such as Paramount and South Gate. She has the pleasure of connecting artists with other organizations and to projects and special events. One notable event that her organization was a part of was the Arts Festival at the LA River. The events allow local artists to display art through pop-ups and visual performing arts. Local cities and community members are encouraged to go and enjoy local art.

When asked about her views on creative placemaking, she emphasized that they are well needed in our communities. She explains that there are no mural or temporary art walls for artists to convey their art in the city of Paramount.

When asked about the role of non-profits, arts, and cultural organizations in combating displacement and gentrification, Leon stated that the main focus is socially and culturally representing the community. She says that non-profits and art are, in a way, the voice of the people. Without the support of cities and the lack of funding, placemaking initiatives can be challenging to create. For this to work, cities and organizations must work together to allow for spaces to be used and developed by communities. City planners are professionals who understand "planning" jargon, whereas community organizations understand community needs much clearer.

Leon believes that cities can do better in embrace art and placemaking by reaching out to local organizations. Communication and partnerships allow for the growth of information and the development of any given community. Unfortunately, due to COVID-19, communication and engagement have been difficult because everything is communicated through video conferencing. She does suggest that after everything is back to normal, cities can reach out to organizations to hold events. As King from Paramount stated, people do not enjoy going to city meetings, and Leon believes community members do not enjoy formal settings. She gave the same suggestion of creating outreach at a local festival or local Friday night markets and can serve as an opportunity to involve low-income families.

Shared Values

Through my research and my expert interviews, I compiled a list of mutual beliefs and shared values. There was this mutual belief that there must be an increase in the education of gentrification and displacement. For the most part, in the communities I interviewed, a lack of knowledge was present, and the difference between gentrification and displacement was misunderstood. The interviewees said that community members see gentrification and displacement as the same thing. When residents hear the word gentrification, the first thing they think about is displacement. What residents do not realize is that displacement is a consequence of gentrification. To best deal with this problem, the interviewees stated that there should be a way to educate community members about the benefits of gentrification and consider their demographics and language barriers. For the most part, these

communities are low-income residents who fear displacement and therefore fight anything that has to do with gentrification. Interviewees stated that cities and organizations must create partnerships between cities, non-profits, school districts, and local businesses. These partnerships generate longing relationships that ultimately benefit the community. For example, over the last decade, the city of paramount has increased its ties with the local school district. Because of this relationship, several art programs were enacted within the city, school art contests that lead to Recognition of the City Council, and city and school district share facilities and programming. One notable feature is that the city raised money for scholarships for the school districts.

Another mutual belief is that there must be city involvement. Cities need to be involved in the constituent's daily lives. For example, the city of paramount holds concerts in the park, and they take that time to go out to the community and survey the community on their needs. Communities can use the time they bring up specific issues in city meetings that community members do not necessarily know about.

Cities also need to encourage art, not necessarily artists from other cities but artists from within. Cities need to be able to allow artists to display art within their city. Cities should also have a balance of affordable housing. Cities must maintain a good balance of affordable housing and the use of art and placemaking for there not to be negative effects of gentrification. Without this balance, gentrification can happen and will more likely occur with displacement. Lastly, community needs must be addressed.

Recommendations and Implications

The semi-structured interviews and the literature analysis provided valuable perspectives on the subject. I have a few recommendations for cities, non-profits, and communities to further the arts and placemaking initiatives to combat the negative effects of gentrification. Placemaking is not a way of combating gentrification, but rather a technique/tool for combating gentrification. One implication that came out of this report is that placemaking cannot combat gentrification alone. Creative placemaking can serve as a tool in combination with other methods.

Based on the literature review and expert interviews, the following are my suggestions for non-profit arts and cultural organizations and cities looking to develop creative placemaking initiatives and services without contributing to the gentrification and displacement movement.

1. Increase partnerships and alliances between city-wide organizations to create art programs, display art, and create public art spaces to further the cultural values of any given community.
2. Use the "meeting to community" model to engage a wider audience and increase participation. Use effective outreach strategies to communicate important events and information to the public in several languages.
3. To increase engagement, use social media to communicate with residents, community organizations, and local businesses.
4. Maintain a balance between art and affordable housing to reduce gentrification-related displacement.

Conclusion

Gentrification and displacement stem from a long history of disinvestment in minorities and low-income populations. It is the role of planners, cities, and non-profits to ensure that the needs of communities and people who are most at risk of being displaced. Communities should be given the tools they need to advocate for resources to allow for a creative expression of identity and culture. With the help of housing strategies, community engagement, non-profits, and cross-sector partnerships, creative placemaking can play a critical role in combating gentrification. Cross-sector partnerships between cities, non-profits, and other organizations can lead to change and advance the conversation between a sense of place and identity. With the help of all these organizations, they can ensure creative placemaking projects can be used to mitigate the adverse effects of gentrification with the help of other tools.

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Appendix

Interview Questions: Miranda Sheffield: Community Activist & Cultural Arts

Commissioner | City of Pomona

1. Can you tell me a little bit about yourself and your background?
2. Is gentrification a growing issue in the City of Pomona?
3. What is the role of the activist to combat gentrification?
4. Do you believe non-profits play a role in combating gentrification?
5. What are some strategies that you know of to combat gentrification?
6. What are your views on art within your community?
7. How important is it for community input and involvement during art projects?
8. Do you believe placemaking can bring investment into Pomona without displacement?
9. What can cities/policy makers do better to mitigate the effects of gentrification?

Interview Questions: John Carver: Planning Director & John King: Assistant

Director | City of Paramount

1. Can you introduce yourself and your background?
2. What are the views of the Paramount planning department on the idea of placemaking?
3. Would you say the arts can contribute to accelerating gentrification?

4. What is the role of the city in combating gentrification?
5. What can be done better to bridge the gap between organizations and city support?
6. Can placemaking and design bring investment and economic opportunities to low-income communities?
7. What barriers prevent this from happening?
8. Do you think that cities or cities in general should have policies to support creative placemaking?
9. What can planners do better to involve the community and support them?

Interview Questions: Mayra Villegas |Artist | City of Pomona

1. What is the artist role to help combat the effects of gentrification?
2. Do you believe that nonprofits and art organizations play a role in combating gentrification and displacement?
3. What are some strategies that you know of to combat gentrification?
4. What are some difficulties of using art to promote culture within communities?
5. How can cities/non-profits work to invest in low-income communities, and bring investment and economic development to support these communities, local business owners and artists without further contributing to the displacement and gentrification of these neighborhoods?

6. Do you believe placemaking and art can be used to combat the effects of gentrification?

7. What can cities/policy makers do better to mitigate the effects of gentrification?

Interview Questions: Daily Leon | Director of Business Development | Latinas

Art Foundation

1. Can you tell me a little bit about yourself and your background?

2. What is the non-profits' role to help combat the effects of gentrification?

3. Does the Latinas Art Foundation yourself have any experiences with creative placemaking projects?

4. What are your thoughts and views on creative placemaking?

5. Do you think that cities and nonprofits should work together to invest in these communities and bring investment and academic economic development through art?

6. What can cities and policymakers do better to embrace art and deter displacement?

7. How can we better engage our communities?

8. What would you like to add to this research project?

Ventura
Katy

Motivation in Student Employees in the Workforce and the Effect it Has on Their Work

Introduction

Motivation is defined as "forces within an individual that account for the level, direction, and persistence of effort expended at work" (Uhl-Bien, Schermerhorn, & Osborn, 2014, p.100). The rapidly changing state of the employment system has made humans resources an indispensable asset in an onganization (Abbas, Ishaq, & Ullah, 2018). This in turn has led researchers and businesses to focus on finding outstanding employees and motivating them to produce quality work and stay within a company. The topic of motivation has now been studied extensively in order to find how it affects the way an employees behave towards work. A study done in 2010 on work ethic in new employees in the workforce states:

Understanding the values of employees is a requirement for any company that wishes to operate with vigor and vitality, and it offers potential benefits to an entire society as healthy organizations can translate into economically prosperous cultures. Key to the future success of any company is its ability to manage, train, develop, and reward a satisfied and motivated workforce at all levels of its organization. (Van Ness et al., 2010)

Yet, most of the studies focus on employment within a big industry or company, which widely varies from that of students.

In the last few decades the number of undergraduate students who work to support their education and financial needs has increased, and it does not seem to be going down any time soon (Lee, Leon, & Youn, 2013). Statistics show that 80% of part-time students and 45% of full-time students face the struggle of juggling their education and professional responsibilities (Lee et al. 2013). Students are an important group that impact both the jobs they hold while continuing their education, as well as the future jobs they will hold once they graduate. For this reason it is important to consider how to motivate student employees and how motivation impacts the work they produce.

An important difference to make note of is that the majority of student workers are employed part-time (Lee et al. 2013). These part time jobs are mostly within the service industry, like retail and food services. Not only is it more cost effective for businesses to hire part-time employees, but these type of jobs give students the flexibility they require to dedicate time to their academic endeavours while holding down a job (Hyun-Woo, Eun-Kyong, & Taylor, 2018). The fact that these jobs held by students are part-time then raises questions as to the attitudes they portray toward them and how it translates into their work. A study done on differences in attitudes between full-time and part-time employees in the foodservice industry revealed that part-time employees have a more negative view of their job in general than full-time employees (Hyung-Woo et.al, 2018). This was seen in the level of commitment to an organization, the satisfaction levels, and the perception of the rewards system (Hyung-Woo et.al, 2018).

Intrinsic and Extrinsic Motivation

As for motivation itself, the contrast between the intrinsic and extrinsic branches of it give light to how students are motivated in their employment. Ellis et.al (2010) defines intrinsic motivators as "those that are internal to the individual, such as satisfaction or pride from completing a task," whereas extrinsic motivators are external forces that incentivize. Examples of extrinsic motivators include a monetary rewards, praise, reminders, and punishments. Employees are better motivated when both types of motivations are incorporated into work areas (Ellis, Arendt, Strohbehn, Meyer, & Paez, 2010). Multi-unit manager Sandra Cain, who has 32 years in the food industry and has been managing students in on-campus dining sectors, agrees with other managers that intrinsic motivation is preferred in an employee as it facilitates job training and requires less use of extrinsic motivators (personal communication, September 25, 2019; Taccone, personal communication, September 23, 2019). A problem that exists is that judging the intrinsic motivation levels is difficult to do and cannot be provided or forced in an employee. For this reason, extrinsic motivation cannot be ignored, and it is up to the managers to provide it.

A concept that ties into the extrinsic motivators is the employee value proposition. The employee value proposition (EVP) according to Uhl-Bien et.al (2014) is an exchange of value between what an employee brings to an organization and what the organization can offer in return. An employee brings in their skills, efforts, time, and commitment, and on the other hand an organization offers pay, benefits, opportunities for personal development, and other perks (Uhl-Bien et.al, 2014, p.120). This concept is set upon the idea that both parties agree on a fair value for what they exchange with each other, and any imbalance leads to less work put in by the employees or less rewards from the company respectively (Uhl-Bien, 2014, p.20) This then leads to the role managers play in motivation their employees.

For a student, there are extrinsic motivators that are unique to them as a group. When looking for a job, students look for organizations that will respect their education and allow them to revolve the work schedule around their classes. It is also likely that a student part-time employee is not looking to advance within the organization they are working at. Because of this, upwards job mobility might not be a viable motivator like in a full-time professional position. On the other hand, if the job is related to their field of study and the experience is valuable for future opportunities, a student is more likely to use that as motivation even if other benefits are not as high (Smith, Holmes, Haski-Levenhal, Cnaan, Handy, & Brudney, 2010).

The Role of Management

Findings in studies have shown that management's behavior and the motivation practices they utilize impact employees' job performance and satisfaction (Abbas et.al, 2018). When employees are motivated to perform their job well and are satisfied with their job, they help the organization achieve its mission and goals (Abbas et.al, 2018). For this reason, organizations dedicate a lot of effort into finding efficient managers. Managers must understand employees as treat them "as humans with social, interpersonal and emotional needs" (Abbas et.al, 2018). When this fact is remembered, managers are better able to find what motivates their employees and what they must do to have a job environment that encourages satisfaction in employees.

Managers must understand and implement the importance of employee recognition programs that celebrate members for their contribution and value (Brick, 2012). According to Brick (2012), rewarding and recognizing employees is one of the six essential elements of a successful organization's infrastructure. It is important to set up the expectations and standards for the job first and then reward successful accomplishments of them (Brick, 2012). Even just vocal recognition on a job well done or a task well accomplished can be very motivating. A point Brick (2012) makes is that rewarding employees has to show that they are valued and not just "make them feel like they are valued." The manager must demonstrate this value to the employees in a sincere and genuine manner.

Although employee recognition is important in any organization, it can be difficult to implement for businesses with a part-time staff and/or mainly consisting of students. Such is the case in college campuses. In many cases it is simply not possible to give raises or bonuses like with a full-time profession. Some managers, like Dawn Taccone, who has been a manager in a university on-campus store for 11 years, opt for giving small rewards like gift cards and certificates of recognition (Taccone, personal communication, September 23, 2019).

Real Managers' Experience

The attitude a manager has towards the work they do and the employees under them plays an important role in how a manager recognizes employees and creates an enjoyable work environment. Manager Dawn Taccone, mentioned before, mentions that when managing students, she sees them as young professionals barely getting experience in "the real world" (2019). She says that she recognizes the need to provide guidance and mentoring, while at the same time giving them her employees the freedom to learn and have fun (personal communication, September 23, 2019). Since she manages a grocery store, her employees' job duties consist of mainly cashiering and store maintenance, as well as customer service. There are hardly any opportunities to move up to a management position there or to make a professional career out of that job. For this reason, she knows that the job is often the first step into stepping into adulthood for some students, and therefore she treats them like a mentor (personal communication, September 23, 2019). Taccone claims to love the store and the people there as if they were her child, who she nurtures and helps grow and flourish (personal communication, September 23, 2019). However, she has a clear distinction of her personal life with that at wok, as, despite everything, does not consider any of her employees or ex-employees her friends (personal communication, September 23, 2019). Because of these attitudes, the store has continued to thrive, and Dawn claims that many employees that graduated have returned, saying that the job taught them significant skills (personal communication, September 23, 2019).

Multi-unit manager Sandra Cain, previously mentioned, has a similar attitude towards her staff. To a customer, her job may seem like it is about managing restaurants in a college and a catering business, or that it is about teaching employees to make sandwiches. She says that anyone can learn to build good sandwiches, but that her job is about people (Cain, personal communication, September 25, 2019). Cain (2019) considers herself a mentor to

638 REACH   Issue 5 Fall '21

Katy Ventura 639

her employees and genuinely cares about them as people, as student, and as her protégés. She emphasizes this point by saying that with every employee, she takes the time to get to know them at a more personal level, establishing trust level from the beginning (Cain, personal communication, September 25, 2019). In contrast with employment outside of a university setting, where employers focus on having staff only, Cain knows that for her employees, their education comes first, and she sees it as a responsibility to allow the job to cater to this (Cain, personal communication, September 25, 2019). She summarizes her motivation strategy as:

[1] Developing a high trust relationship, [2] learning about that person and finding out what motivates them [3] and give that to them. If it is praise, if it is [good job], if it is being recognized in a group setting, or a private note. Just find out what motivates people extrinsically and then just building that relationship. (2019)

Cain (2019) believes that in the industry she is in, a strategy like that of Amazon could never work. A former Amazon employee, Breanna Ramirez, who is also a student at a Cal State University, describes the job as very demanding and tiring (Ramirez, personal communication, September 22, 2019). She worked at a warehouse locating packages in storage and bringing then down in a lift to be shipped, a duty that was physically strenuous (Ramirez, personal communication, September 22, 2019). Employees there must meet a quota daily, which mean there is hardly time to rest or do anything else, and it causes stress. Despite the negatives of the job, Ramirez (2019), thinks the job provides enough extrinsic motivators to encourage employees to stay. Amazon offers competitive pay, multiple benefits like health insurance and financial bonuses to help pay for college (Ramirez, personal communication, September 22, 2019). But even with the high incentives, a student could hardly accept the job without many sacrifices. Amazon adjusts to a student's school schedule, but that simply means working nights instead of giving flexibility and being less demanding (Ramirez, personal communication, September 22, 2019). Managers do not put effort into knowing their employees, but rather depend on small "team-building exercises" and meetings at the end of shifts, which do not help with motivation (Ramirez, personal communication, September 22, 2019). In environments like these, there is hardly, if any, intrinsic motivation in employees. Students would have a difficult time making their education the primary concern with a job in these organizations.

HYPOTHESES

Motivation alone is a topic that is expanse and difficult to implement because, when in practice, not all employees are the same. What works to motivate one person might not motivate another. This topic specifically with student workers presents different challenges. Managers can find it difficult to motivate their student staff when for the students, their job is temporary and insignificant in their professional career. The differences in student employees' motivations led to the following hypotheses:

H1: Student employees dedicate less effort into jobs that do not relate to their future careers than jobs that do.

H2 Student employees valuing a close relationship with their manager feel more individually appreciated at work when given praise from said managers.

H3: Students working in the service industry value sympathetic manager skills (Patience, Kindness, Understanding) and a deep bond with a manager.

This hypothesis essentially is divided in four sections where student workers in the service industry are compared to students working in other industries.

- H3a: Students working in the service industry value Patience as a manager skill over students in other industries.
- H3b: Students working in the service industry value Kindness as a manager skill over students in other industries.
- H3c: Students working in the service industry value Understanding as a manager skill over students in other industries.
- H3d: Students working in the service industry value a close bond with a manager skill over students in other industries.

H4: Student employees will put more effort into a job that holds their role of students as important and a main concern.

METHODOLOGY:

Design and Procedure

In order to collect data to test the hypotheses, a twelve-question survey was sent out among the university students of Cal Poly Pomona. This survey was done using the free template on SurveyMonkey. The first question asked student participants to rate four choices in order from most to least important consideration when searching for employment. The four options were good benefit (time off, health insurance, etc.), pay, a good/enjoyable work environment, and a flexible schedule. The second question asked students to rank the effort they personally felt they put into their current job from one to ten, the latter being the most effort possible. The next question asked students to give their opinion on how valuable to them was a close relationship with their manager. The options ranged from "Extremely valuable" to "Not at all valuable". The fourth question, once again, asked student participants to rank the kinds of attitudes they valued most in a manager from most to least valued. These attitudes and traits included a range of what are considered "nice" to "strict" such as being kind, understanding, patient, reliable, honest, trustworthy, authoritative, and strict. Following this question was another ranking question asking students to rank, from most to least important, what made them feel appreciated at work. The options for this question included "verbal praise from manager," "recognition in front of peers," "rewards system based off performance," "relative freedom/low strictness derived from trust," and "incentives/perks." Question six asked students to pick how important it was to them personally that their manager respected and took into consideration their status as a student at work. The five options here ranged from "greatly important" to "not at all important." The seventh question was directly related to the previous question, as it asked students to, from one to ten, rank how much they thought their current manager respected that role as

a student. Question eight was a yes or no questions asking students to state whether their job now related to their future career. The following four questions were mostly asking for demographics. Question nine and ten asked students what their current academic standing and age was, respectively. The next two questions asked students what industry their job belonged in, whether the service industry, manufacturing, an office job, or self-employed, and then whether this job was part-time or full time.

Due to the online nature of the survey, distribution was done online as well to gather the responses. The first attempt was sharing a post with the link to the survey on the Cal Poly Pomona subreddit, which is frequented by almost 9,000 users. The subreddit is a popular site that many students across the colleges of the university use to post surveys required for class assignments. The post invited students currently employed to take the survey, which only took three minutes or less to complete and would maintain their responses anonymous, encouraging them to help a fellow student in their coursework. The survey was up for two weeks, and during this time 65 students responded to the survey. To obtain additional responses, students employed in places on campus were asked to take the survey as well, since they already fit the targeted demographic. Students were asked to share the survey among friends if possible. Both a web and a mobile link were provided for students to take the survey. At the end of the two weeks a total of 89 responses were collected from students across campus. Attempts were made to collect a minimum of 100 responses by posting the survey on other social media pages such as Facebook and to groups of students from other universities, but they were not obtained.

RESULTS

Participants

The total number of participants for this study amounted to 89 random, willing students (n=89). The only requirement for a student to take the survey was to be employed, but aside from that no specific demographic was targeted. All the respondents were Cal Poly Pomona students. Based on the demographic questions included in the survey, the results revealed that the majority of respondents, 34 to be exact, were Senior level standing. This constituted 38.20% of the total number of participants. This category was followed by students at a Junior level with 28 participants (31.46%), and then Sophomore with 17 participants (19.10%). There were only 7 (7.87%) Freshman standing students and only 3 (3.37%) Graduate level students. Most of the students fell under the age range of 18-21 years old, with 61.8% belonging to this category. 22.47% of the 89 participants were 22-25 years old, and lastly 6.74% were under the age range 26-30. None of the respondents fell in the "30+" years old category. Most of the students surveyed overwhelmingly put that they worked part-time, with 81 of them picking this option. Only 9 of the participants worked full-time jobs. The last demographic categorized student respondents based on industries they worked at. A majority of them, 45 to be exact, worked in the service industry. 23 students worked office jobs, followed by 14 that picked the "other" option, and only 7 worked in the manufacturing industry.

Perceived Effort Put into Jobs

In order to test Hypothesis 1, that student employees dedicate less effort into jobs that do not affect their future careers than jobs that do, the answers to the second and eighth questions of the survey. All the responses to the question asking students to rank the effort they put into jobs were positioned side by side with their respective responses to whether the future job of the student related to their career. Based on these responses alone, in excel, the number of students who claimed they put effort as less than or equal to five on jobs not relating to their career, the median option, was only seven out of the 65 total students that responded that their current job was not related to their career. The number of students that claimed their effort was greater than or equal to 8 in jobs not relating to their careers was 46 out of the 65 totals. The "greater than or equal to 8" variable was considered in this data to evaluate the effort as "high" At a glance, these results already appear to not support H1, as the majority of students that are not working at jobs relating to their future careers consider themselves to put high effort.

Excel was also used for the actual hypothesis test. A t-Test was done using the Data Analysis feature in Excel to find the p-value in "Two-Sample Assuming Unequal Variances" t-Test. The independent variable was whether the job students had related to their future careers. Therefore, there were only two variables: Yes and No. The test was conducted using an α= 0.05 value.
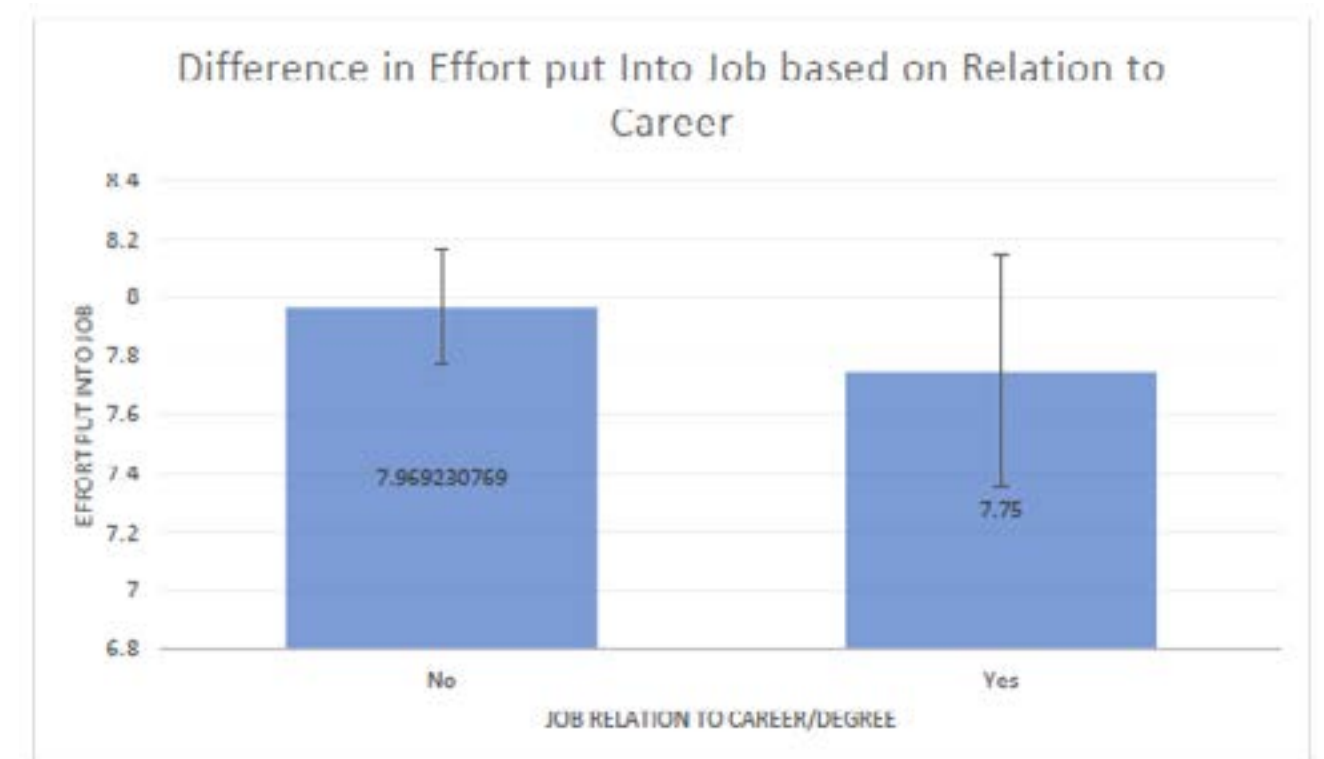

Figure 1

The results from the t-Test revealed that the mean effort put into the jobs by those that responded that they do not work on jobs related to their career was 7.969. Whereas those that stated that their job did relate to their career had a mean of 7.75. Figure 1 shows the chart summarizing the means of each option and the standard error of each. For the variable "No" the standard error was 0.196 while for "Yes" it was 0.396. The t-Test also revealed the p- statistic to be p= 0.311 for a one-tail test, and therefore was not less than the α=0.05. H1 is rejected as there is not enough evidence support the hypothesis that student employees dedicate less effort into jobs that do not relate to their future careers in comparison to those in jobs that do.

Value of Manager Praise

H2 stated that student employees valuing a close relationship with their manager would feel more individually appreciated at work when given praise from said manager. Based on the responses to questions three and five, specifically the rankings for the option "Verbal praise from manager, the data was used to create another t-Test of two samples assuming unequal variances. The independent variable constituted the value of the relationship between the student worker and their manager to said student. Those that ranked the value of a close relationship as "Very valuable" and "Extremely valuable" were used to make up the number of students that valued the close relationship. This group was made up of 57 students (64.04%). Those that ranked the value of manager praise as a one or two on the question of what made them feel more appreciated at work made up the category of students that valued manager praise. 48 (53.93%) participants in total claimed to highly value manager praise, with 34 students ranking it in the number 1 spot and 14 students ranking it as second. Using these classifications, a total of 12 students (13.48%) both valued a close relationship with a manager and valued manager praise to feel appreciated.

Data Analysis was again used to conduct the t-Test, and the α= 0.05 as well. The results yielded a mean of 2.386 for those that valued a close relationship and a mean of 2.343 for those that did not value a close relationship with the manager, expressed as "Close" and "Not Close" respectively. As can be observed in Figure 2, which also shows the standard error for both options, provides an image of the closeness of the means. The p-value for of this one-tail t-test came out as 0.442, which again, was not less than the α= 0.05. Therefore, the null hypothesis fails to be rejected, which means there is not enough evidence to show that student employees having a close relationship with their manager feel more individually appreciated at work when given verbal praise by said managers.
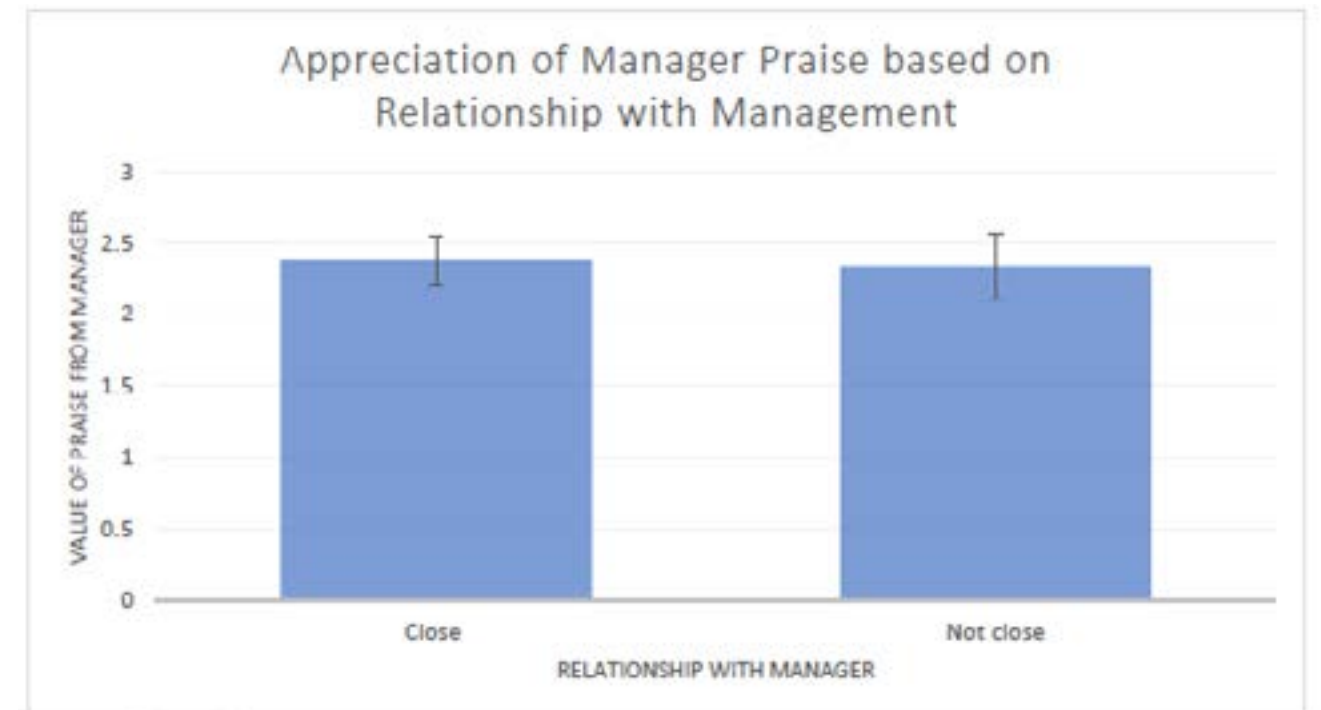
Figure 2

Values Within the Service Industry Compared to those Elsewhere

H3 was separated into four sub-hypotheses in other to better analyze the results of the data and conduct four separate one-tail t-Tests for two samples assuming unequal variances. Before using the data analysis tool, the answers to the survey were gathered and grouped, revealing that 45 students (50.56%) worked in the service industry. As calculated during H2 data analysis, the number of students that valued a close relationship with the manager, given the same parameters as in H2, were 57 (64.04%). The perceived value of the skills/attributes was based on the responses that classified the skills at rank 1 or 2 above all other skills for each of them. The results were as followed: 18 (20.22%) of students valued patience in a manager above all other skills, 46 (51.68%) valued an understanding manager above all other skills, and 27 (30.33) valued kindness in a manager above all other skills. At first glance this appears to support H3 as a whole, when grouping all students that value the three sympathetic skills (patience, kindness, and understanding). Further grouping revealed that a total of 40 students out of those in the service industry (88.89%), highly valued sympathetic manager skills and a deep bond with a manager, which also supported H3. The induvial t-Tests for each skill revealed otherwise. All t-Tests used service vs non-service jobs as the independent variable and α=0.05.

Figure 3

The first t-Test conducted aimed to test hypothesis H3a, which tested the value of Patience. As shown in Figure 3, the means between those in the service compared to those in a n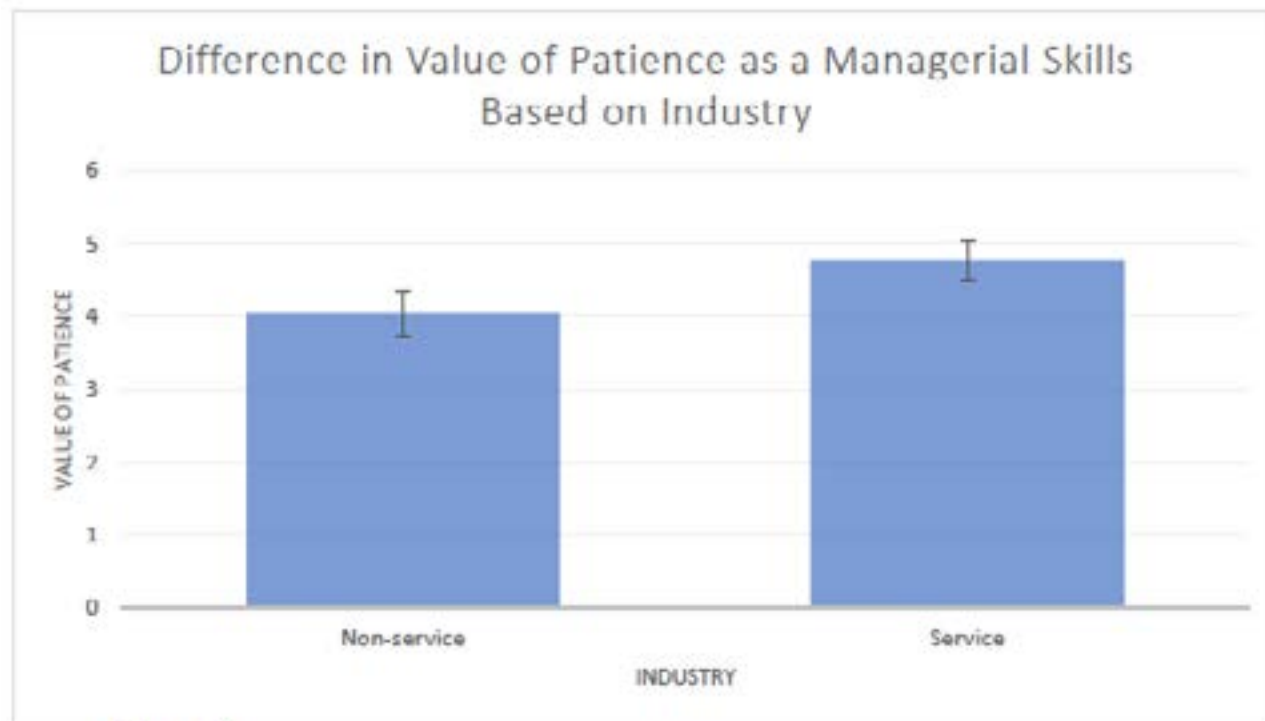on-service industry hardly varied (4.777 compared to 4.045), with a very similar standard error as well (0.271 and 0.299 respectively). The p-value for the one-tail test was p= 0.036, which meant that the null hypothesis would be rejected. Therefore, there is enough evidence to show that students working in the service industry do value Patience over those in other industries.
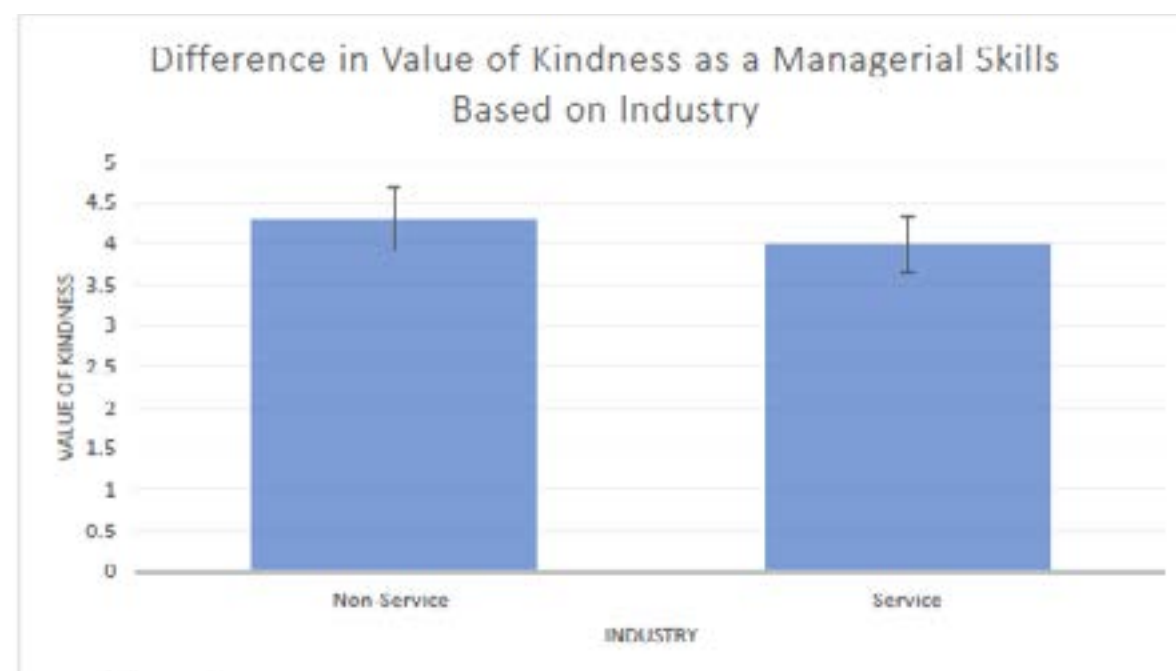
Figure 4

The second test conducted tested hypothesis H3b to find evidence of whether students in the service industry valued Kindness above those in other industries. Figure 4 shows the mean value of kindness within students in non-service industries (4.318) compared to the mean of value of those in the service industry (4). The standard errors, (0.299 and 0.271 respectively) are also displayed in the graph. The p-value of this one-tail test came out as p= 0.37, which is not less than α= 0.05. Therefore, the null hypothesis fails to be rejected, as there is not enough evidence to show students in the service industry value kindness over those in other industries.

H3c was tested in the same manner as the other hypotheses before, but this time testing the value of Understanding as a managerial skill in relation to the industry the students worked at. The means of the value of Understanding hardly differed between industry sectors. Those not in the service industry had a mean of 3.022 and standard error of 0.289, whereas those in the service industry had a mean of 3.133 and a standard error of 0.351, as can be seen in Figure 5. Using the data analysis function on excel, the p-value for the one-tail test was p=0.404, which again was less than the α= 0.05. This meant that the null failed to be rejected again, as there was not enough evidence to show that students in the service industry value the quality of being understanding in a manager over the students working in other industries, according to the n=89 sample size.
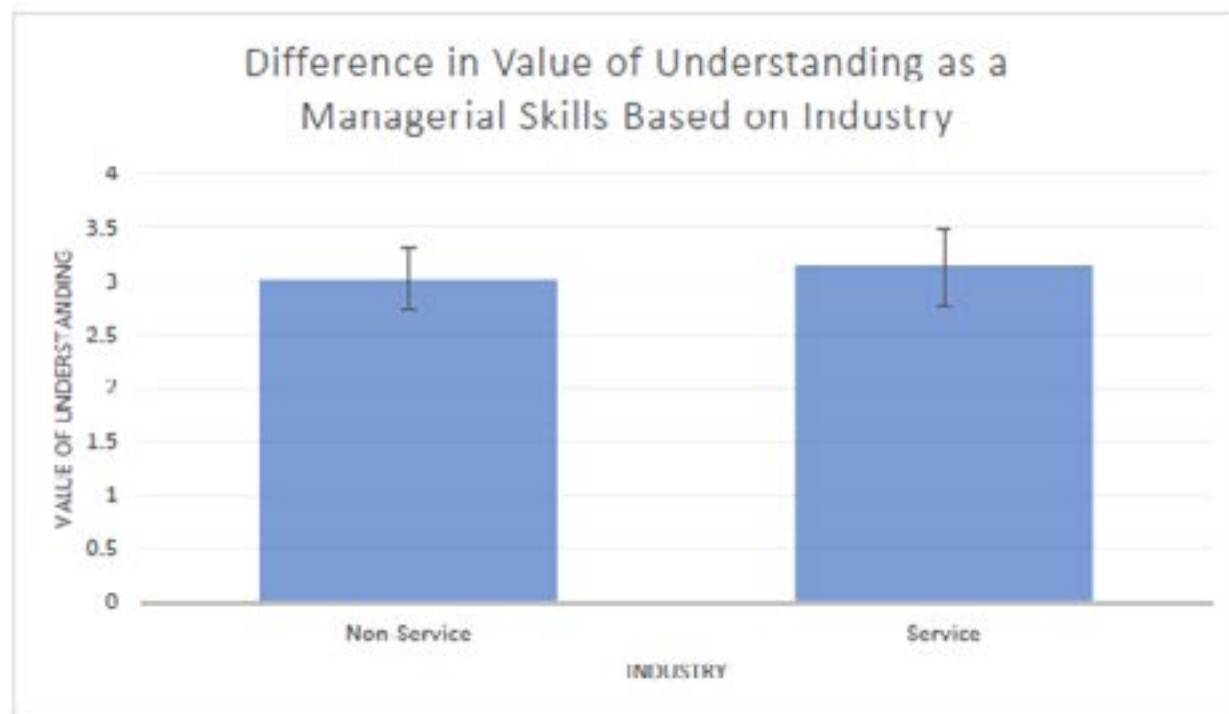
Figure 5
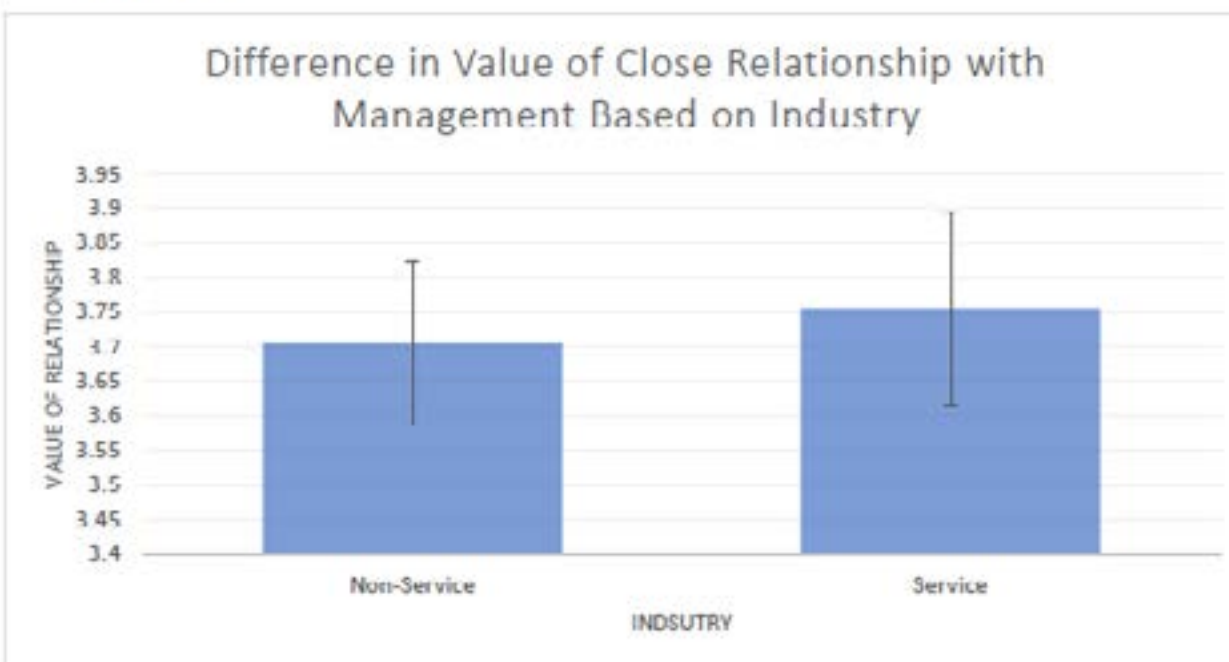
Figure 6

H3d was the last sub-section of H3 to be tested regarding the value students put on having a close relationship with their manager based on the independent variable. The variable was the industry the student respondents worked at. Once more, the means between the independent variables varied only very slightly, with the students working in the non-service industry having a mean of 3.704 and those in the service industry having a mean of 3.755. The standard errors, similarly, were 0.119 for those in the non-service industry and 0.139 for those in the service industry, as seen in Figure 6. A t-Test was conducted using the data, that revealed a one-tail p-value of p= 0.391. This p-value, too, was not less than the α= 0.05, meaning that the null failed to be rejected. There was not enough evidence to show students in the service industry valued a close relationship with their manager over those in other industries.

Role as Student in Relation to Effort Demonstrated

The last hypothesis, H4, predicted that student employees would put more effort into a job that holds their role of being a student as important. The data on the second question of the survey was used to determine the levels of effort. "High effort" was made up of those student respondents that stated they put higher than or equal to "8" effort on a scale of 1 through 10. The number of students claiming this were 59 out of 89 (66.29%). The importance of managers respecting a student's role as being of high importance consisted of those respondents of question six on the survey that chose the options "Greatly" or "Significantly" important. Combined, this gave 67 students (75.28%). For the responses to question seven, about the actual importance managers put into student's role, only the ones greater than or equal to 8 were also used to determine managers that considered the role important. The yield of this was 66 students (74.15%) that had managers who respected their student role. Using these parameters, a total number of students who put high effort into a job and have managers that highly respect their roles as students was 49 out of 89 (55.05%), so a majority. Based just on these statistics, H4 seems to be supported.

A t-Test of two-sample assuming unequal variances was conducted here as well using the data analysis tool in Excel. The independent variable here was the determining factor of whether the job students currently held saw their role of students as important or not. The means here varied significantly. The mean of the "Important" variable was 8.166 and had a standard error of 0.180, whereas the mean of the "Not Important" variable was 7.173 and the standard error was 0.424. The results of this can be observed in Figure 7. As for the p-value for the one-tail test, the results came back as p= 0.019. This value is less than the α= 0.05, which meant that the null hypothesis could be rejected. Therefore, there was enough evidence to show that students do put more effort into a job that holds their role as students as important and a main concern.
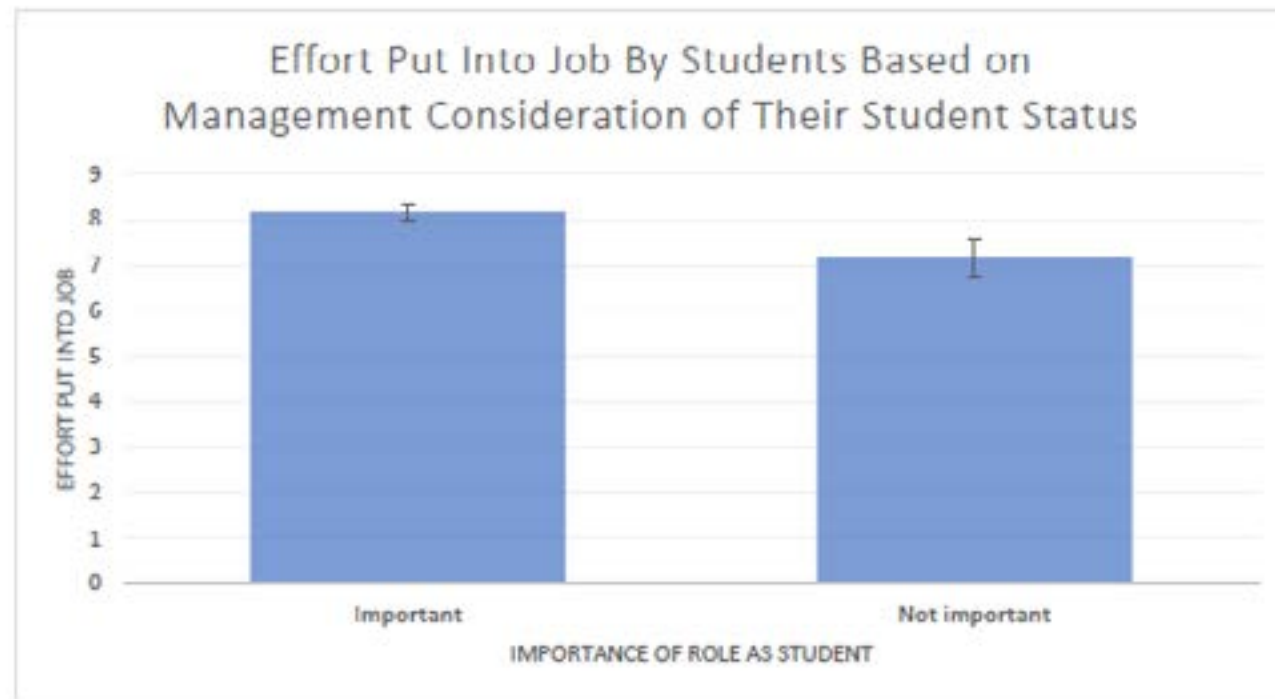
Figure 7

In addition to the t-Test, a simple regression analysis was also performed. This was done because both the "Effort" and "Importance" variables are continuous, so the regression analysis was to find the correlation between the two. This way, the importance of the role as a student being over or equal to 8 did not disregard the rest of the data about it (Kukita, personal communication, December 4, 2019). Likewise, with the effort, so this way the rest of the data could be taken into consideration. Using the Regression option in the Data Analysis function, the data under the "Effort" column was entered as the Y-range and the data under the "Actual Importance" column became the input for the x-range. The regression analysis was run under a 95% confidence level. The results showed that the p-value equaled 0.0002, and therefore still less than the α. The chart, Figure 8, shows the linear predicted effort based on the actual effort from the data in regard to importance. This is proof that a positive relationship does exist within the x- and y- variables. Therefore, effort put into jobs by student workers increases as they perceive that their manager puts more importance into their role as a student.
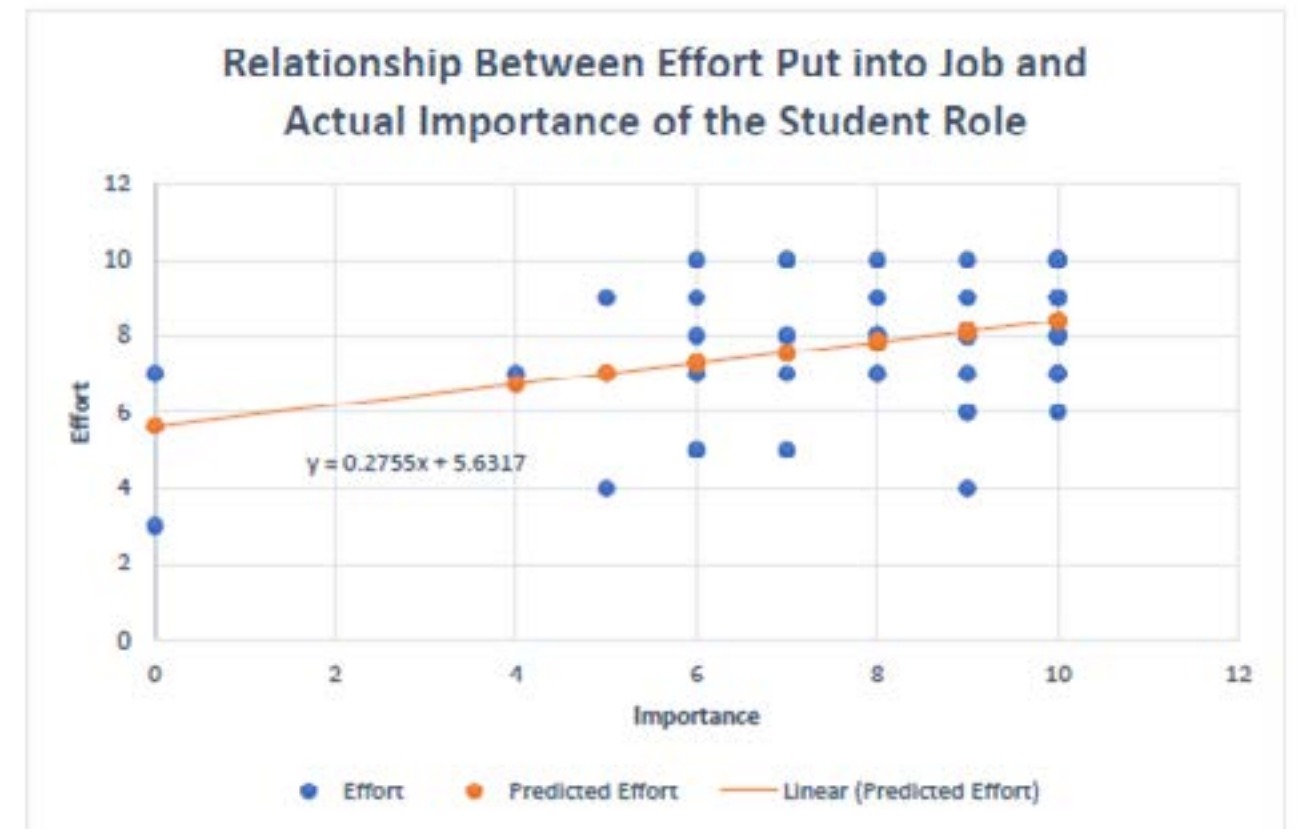
Figure 8

DISCUSSION

The results of the survey study aimed to show possible differences between student employees, given that the fact that they are students affects the jobs they can obtain and keep. As mentioned in the introduction, student employees do face the challenge of managing employment and education (Lee et al. 2013). Thus, this led to hypotheses that strived, not to expose these challenges, but rather to discover characteristics and attitudes towards jobs and management. A misguided belief that conducted the direction of the hypotheses and research was that student employees put less effort in general and cared more about their future opportunities instead of the present job responsibilities. This was proven wrong based on the responses from the sample population. Contrary to this belief, a majority of students in jobs that did not relate to their future careers put, what they consider to be, high effort, if not the most effort possible. H1 turned out to not be supported by the findings.

This study did not research the reason why student employees turned out to put more effort into jobs not relating to their career than those in jobs that did. Therefore, it is difficult to pinpoint the reason behind these results, and only speculations can be made. A significant factor that could have played a role in these results is the money or pay motivator. Most students chose this as the most important factor to consider when looking at a job opportunity. This can be interpreted as students deciding to put effort based on the pay, regardless of whether the job related to their career or not.

Another possible influencing factor to job effort could be work culture, which was not explored in this study. According to the results from Ellis et.al (2010) "Varying influences of motivation factors on employees' likelihood to perform safe food handling practices because of demographic differences," part-time jobs lead to considerably different work culture than full-time jobs. Students tend to obtain mostly part-time jobs, as proved in the survey data, which can in turn mean that the work culture plays a role in the enjoyment at the workplace and effort put into the work.

The study did not prove the importance and value of a close manager relationship, as hypothesized in H2 and H3d. While this may show that managers need not strive to create a meaningful relationship with their student employees, it does support other research that establishes management's behaviors as an indispensable factor in job performance and satisfaction (Abbas, Ishaq, & Ullah, 2018). H4 directly supports this since it proves that students do put more effort into their job if this job holds their job as important, and that effort has a direct positive correlation to how much importance is placed in this role. Managers are the ones responsible of taking this role of being a student in their student employees as important. This importance can be perceived, for example, in the schedule. By giving them hours that do not interfere with their classes and allows them time to dedicate to their studies, managers show care and consideration to their student employees.

The research done based on H2, however, proved that student employees place high value in verbal praise from their managers and leads to them feeling appreciated. Solely on this data, managers can assume that their words do matter and that simple praise can boost spirits and motivate. Managers are encouraged to find what motivates their individual employees in order to have more satisfied employees that perform well (Brick, 2012).

H3 directly observed the values of student workers towards certain characteristics and behaviors of managers. This hypothesis focused on comparing the difference in values between those in the service industry and those in other industries. Based on the results, only the characteristic of patience was shown to be valued by students working in the service industry compared to students working elsewhere. In the service industry, patience in a benefitial and often essential quality to have, since it involves working directly with the public. Therefore, it is not too surprising that student workers value this attribute and value that a manager displays it with customers and employees.

Without taking into consideration other variables and just based on raw data, students did overall value a close relationship with their manager and sympathetic qualities in them. This directly supports the claims manager Sandra Cain (2019) made, that building trust and a close relationship with her student employees based on their motivatiors has led to better employees. Other studies have shown that positive and sympathetic management behavior can even resolve conflicts before they occur or create further problems (Abbas, Ishaq, & Ullah, 2018).

Study Limitations

This research study in no way represents the attitudes and beliefs of a majority of student in the workplace. The sample size of 89 students who completed the survey is not large enough to be accurate. A bigger sample size could better reflect the thoughts of students. Due to the survey being shared on social media, the results excluded a large portion of the student population at Cal Poly Pomona that do not frequent that particular site.

Another limitation is that this study did not consider the demographics of the respondents. Since demographics involving ethnicity or race, gender, and economic status were not present in the survey that was distributed, the results could be an inaccurate representation of the Cal Poly Pomona population. The study only consisted of Cal Poly Pomona students, which means that the results also do not reflect the thoughts of the student population at other colleges that is employed overall . This university is more diverse than others in terms of demographics, and because the survey did not record that, it is impossible to know if these factors influenced the responses. Studies have shown that demographics affect whether a student decides to get a job or not (Lee, Leon, & Youn, 2013). For example, Asians are less like to work and study, choosing to focus on their education, and students with more economic needs will most likely be working while studying (2013). Therefore, in regards to the survey, it is possible that some groups of students were excluded from the study completely.

Further Research

The results of this research project pave the way to do future research in specific motivating factors of students and how much each influences the quality and effort of their work. This study glossed over the things that motivate student workers without tying it directly to other factors. Future research can be done on how managers utilize these factors to motivate their student employees. The impact of intrinsic compared to extrinsic motivation was not explored in this research, as it can be difficult to find ways to measure intrinsic motivation. With further research, a method to measure this motivation can be used to then apply it to independent factors, like how it relates to the effort put into jobs and if students are more prone to display one over the other.

Another topic worthy of research is the effect that a job during the higher education years of a person has on their future career and attitudes towards their future jobs and managers. The years a student in in college are often a time that shape a person's work ethics and molds them to be future professionals (Cain 2019). It would be interesting to analyze how the views of a person have changed from their college years to their post-college life. This would require following a set of participants for a considerable amount of time, but the research from this study could be used to document the general attitudes and thoughts of student employees as a group.

The findings of this research can be used to further study if the thoughts of students widely vary from those peers their age that did not attend college. A thorough study that better compares working students and employees who are not students could reveal improved methods to motivate and manage both groups in a more efficient manner.

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Verdugo
Daniela

The Interplay Between Stressors and Resilience from Adolescence to Young Adulthood

Introduction

Historically the concept of invulnerability from harmful influences has been associated with the concept of resilience (Masten & Obradović 2006). While the concept of resilience is understood in a general sense, measures associated with the concept are not always well understood. For example, in developmental psychology and social science research, coping, hardiness, adaptation, mastery, adjustment, and persistence are often used to describe resilience (Windle 2011). The idea of resiliency refers to processes that are at work, interrupting the path for being at risk for problem behaviors. Resilience is viewed as a positive concept that implies strength, power, and hardiness. The concept of resiliency represents an explanation of why some children show successful adaptation despite exposure to threatening situations. Resiliency and vulnerability are often viewed on opposite ends of a continuum (Masten & Obradović 2006). When an adverse life situation occurs, the individual either becomes vulnerable to the situation and is unable to cope with the consequences, or is not susceptible to the negative impact, thereby exhibiting resilient characteristics. Resiliency is often discussed in combination with risk factors and protective factors. The literature suggests that resilience can result from the interplay between these factors.

One of the main goals of resilience research is to better understand what resilience means and to identify the diverse factors that make someone a resilient individual. What is the relationship between resilience and emotional wellbeing among adolescents?

One in five adolescents, ages 12 to 18, suffer from mild to severe mental disorders, which tend to develop in their early lives (National Institute of Mental Health, 2017). This is a problem that is of importance since suffering from mental health disorders can be detrimental to a person's life. Thus, this study examines resilience connected to children's emotional wellbeing (e.g., depressive symptoms). Understanding the mechanisms that generate resilience in children,can inform us about the nature of resilience and how to overcome hardship or strainful situations to decrease the risk of mental health issues.

Before we discuss the preliminary findings, we review some relevant findings from psychology and social science researchers about resilience and additional concerns they raise for the study of resilience.

Research on Resilience

Developmental psychology and social science studies have examined the concept of resilience from a range of perspectives – accounting for personal characteristics, environmental factors, or viewing resilience as a process (Luthar et al. 2000, Masten 2007, Vanderbilt-Adriance 2008). While most research agrees that resilience represents some form of overcoming adverse circumstances or "bouncing back," the complexities of defining resilience or measurement of resilience remain challenging (Windle 2011). Moreover, how resilience is conceptualized varies by discipline. This report explores resilience from a

socio-psychological perspective. The main focus is to understand further the relationship between resilience, risk behavior, and depressive symptoms. We also examine items of resilience compared to a resilience scale to further understand the dynamic effects of resilience during adolescence. We argue that some of the resilience measures may matter at different points in time -through learning how to handle adverse experiences, children's resilience may evolve. Using a resilience scale might mute potential factors or characteristics to effectively capture the process of adapting or managing experiences or observations of stress or trauma. For this report, we review resilience from a person and environmental perspective as well as the early life course.

Personal Attributes and Environmental Perspectives on Resilience

From a person-focused perspective, a person's qualities determine whether and how the individual goes through and overcomes adversities and most likely "bounces back" (Roth 2007). Given these personal attributes, research assumes resilience to be more invariable or fixed. Personal characteristics may protect against adverse life events, trauma, or stress through useful resources (Roth 2007) and healthy coping skills.

Other factors associated with resilience are family and community conditions. In a study of Mexican-American immigrant families, the researchers aimed to describe and examine how the issues for Mexican parents that are raising American-born children can affect the child's resiliency and how these obstacles differ from other immigrant populations in America in the way they support the children (Chavez 2018). They found that interventions at the macro-level have the most impact in all communities, and these interventions can benefit immigrant communities, such as parenting groups. This research demonstrates that family upbringing can affect the child's resilience, highlighting the importance of parenting styles and the support that children need to be more resilient. Another study also argues about how vital outside support can be for resilient children (Turner 2013). In this study, the researchers examined resilience in the presence of community disorder, mental distress, victimization, family support, and adverse life events to further explain the association between these variables and resilience. The researchers concluded that youth that lives in highly disordered communities experience higher levels of psychological distress (Turner 2013). In other words, if children grow up in highly disordered communities, they will be more susceptible to psychological disorders. In another study, researchers examined the relationship between educational resilience and family support. The focus of this research was to explore familial and outside familial relationships across groups and whether support from non-parents protects against academic risk. The AddHealth findings suggest that while the relationship between the adolescent and parents and the relationships between the adolescent and other peers can interact, they are not significant enough to be considered a protective factor for academic resiliency. One of the limitations mentioned in this study was that the researchers could have measured resiliency more directly from the participants. Overall, these findings demonstrate the significance of outside support in the children's upbringing and how external factors play a role in mental health and resilience.

Resilience in Mental Health

One of the common themes in the resilience literature has been focusing on mental health outcomes such as depression, anxiety, and addiction, associated with resilience. A foundational article on vulnerability and resilience, examines stress, competence, and depression among high-risk adolescents (Luthar 1991). Luthar questioned whether resilient children exhibit higher symptoms of anxiety and depression, in the presence of high degrees of competence. The measures used include a Life Events Checklist (Johnson & McCutcheon, 1980) and a Children's Depression Inventory (Kovacs, 1982). The results revealed that children who were considered to be resilient were more depressed and anxious than other competent children who did not endure as much stress. In terms of the variables, ego development was compensatory (meaning it influenced competence) to stress, internality and social skills were protective factors, and intelligence and positive events were vulnerable during these events. The findings of this study demonstrate that looking at mental health is important to better understand a possible relationship between mental health and resilience.

Other research explored the relationship between substance abuse and resilience (Larm 2010). The goal in this longitudinal study was to examine resilience in adolescents who had received treatment for substance misuse, to explain the continuity or discontinuity of resilience,by investigating person characteristics (Larm 2010). Latent growth models (2004) were used to identify the trajectories of resilience. The findings revealed that those who had misused substances during their adolescent years were significantly less likely to develop resiliency later in their life (Larm 2010). The common theme within these two studies was that the researchers both placed importance of resilience associated with mental health during adolescence. Some gaps in the literature point to the need of expanding research to different settings and diverse populations of children across different developmental stages (Turner 2007).

Resilience and the Life Course

A key assumption of the life course perspective is that human development advances in the context of social relationships that consequently shape and alter the development of human behavior and emotions (Elder et al. 2003, Thornberry et al. 2003). A significant first social connection is the parent-child relationship (Ross 2017). This important relationship is also associated with various positive (self-reliant social behavior) as well as adverse behaviors (poor conduct in children as a result of poor parenting) (Bariola et al. 2011). Studies have linked the impact and intensity of parental stressors to children's development trajectories (Elder et al. 2003, Galambos et al., 2018; Lerner & Steinberg, 2009; Yap et al., 2007). Thus, different mechanisms may apply to explain the responses to parental and environmental adversities on depressive symptoms and resilience at different stages from adolescence to young adulthood (Elder et al. 2003).

The life course approach considers the complexities of resilience by examining resilience as a process – instead of a static concept (Windle 2010). This further implies that resilience potentially shifts and changes throughout the developmental stages. Resilience operates across different person-level characteristics (e.g., wellbeing, age, gender)

and contextual-levelcharacteristics (e.g., neighborhood, school context), which also can interconnect with each other. For example, in a prominent study of neighborhood context and deviance, Sampson and colleagues argued to consider dynamics of change to better understand behavior (Sampson, Morenoff and Gannon-Rowley 2002). Very few researchers have been able to follow this suggestion due to data or methodological limitations. An exception has been a longitudinal study from Chicago which shows that moving from crime-prone neighborhoods to safer areas increased adolescents' self-efficacy (Dupéré, Leventhal and Vitaro 2012).

Resilience has also been identified as an essential factor that helps individuals in coping with stressful factors or circumstances (Masten 2001). While some studies have identified factors that contribute for example to negative mental health outcomes of risk of adolescent offending (Dahlberg and Simon 2006), research remains sparse about the impact of resilience of youth transitioning from adolescence to young adulthood.

Study Description

The sample of adolescent respondents for this research was drawn from the National Longitudinal Study of Adolescent to Adult Health (Add Health-Public Use data files). The Add Health study has been designed by researchers at the University of North Carolina with a focus on adolescent health. The Add Health study is the largest and most comprehensive longitudinal study of adolescents. Initiated in 1994, Add Health has been supported by four program project grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), National Institutes of Health (NIH) with co-funding from 23 other federal agencies and foundations (University of North Carolina 2020).

The study started with an in-school questionnaire administered to a nationally representative sample of 7th to 12th graders during the 1994-95 school year. The study followed up with a series of in-home interviews conducted in 1995, 1996, 2001-02, 2008, 2016-2018, and still ongoing. Other data sources consist of survey responses from parents, siblings, fellow students and school administrators, and interviews with romantic partners, only available with a restricted data-use contract. Add Health also provides information about neighborhoods and communities.

The Add Health study consists of survey responses from five waves of data. Each wave combines longitudinal survey data on respondents' social, economic, psychological, and physical well-being with contextual data on the family, neighborhood, community, school, friendships, peer groups, and romantic relationships. Thus, providing unique opportunities to study the relationship between social environments and behaviors in adolescence connected to health and achievement outcomes in young adulthood. Publicly four out of the five datasets are available for study.

Public-use data for Add Health are collected from multiple sources. Wave I was conducted from September 1994 through December 1995, Wave II was conducted from April 1996 through August 1996, in Wave III responses were collected from August 2001 through April 2002, and in-home interviews in Wave IV were conducted from January 2008 through February 2009.

For this report, we examined responses from Wave I. We also explored the longitudinal nature of the data in our preliminary findings. However, this component is still in a data exploration phase. Overall, in our study, we take advantage of the waves that focus on adolescents' health and risk behaviors to capture the influences of these factors on depressive symptoms in the presence of resiliency.

This study uses regression analysis and a mixed model approach to analyze resilience and depressive symptoms among a representative sample of adolescents in the United States.

Key Measures

In order to measure depressive symptoms, items were chosen based on the Epidemiologic Studies Depression Scale (CES-D). A scale was created using a total of 13 items with a Cronbach's Alpha of .75. The items were all coded to reflect high levels of depressive symptoms. The scale includes the following items: (1) "You don't feel like eating, your appetite was poor", (2) "You felt that you could not shake off the blues, even with help from your family and your friends", (3) "You felt that you were just as good as other people", (4) "You had trouble keeping your mind on what you were doing", (5) "You felt depressed", (6) "You felt that you were too tired to do things", (7) "You felt fearful", (8) "You talked less than usual", (9) "You felt lonely", (10)"People were unfriendly to you", (11) "You felt sad", (12) "You felt that people disliked you", and (13) "It was hard to get started doing things."

The measure of resilience consists of six items with a Cronbach's Alpha of .68. The items were coded to reflect high levels of resilience. The following items assess resilience: (1) "You were bothered by things that usually don't bother you", (2) "You felt hopeful about the future", (3) "You thought your life had been a failure", (4) "You were happy", (5) "You enjoyed life", and (6) "You felt life was not worth living."

Additional person attributes and external factors employed in the analyses are presented in Table 1.

Table 1. Summary Statistics for Regression Analysis (N=6,446)

	Mean	Std.	Min	Max
Depressive Symptoms	1.354	1.93	0.00	13.00
Resilience	23.293	3.23	0.00	28.00
Risk Behavior	3.016	1.13	1.00	5.00
Suicidal Behavior	.127	0.33	0.00	1.00
Neighborhood strain	2.923	1.02	0.00	4.00
Warm relationship with parent	1.695	0.88	1.00	5.00
Age	15.808	1.60	13.00	18.00
Sex	.516	0.49	0.00	1.00
Religiosity	1.637	0.75	1.00	4.00

Preliminary Findings

Descriptive Analysis

The findings in Table 2 indicate a negative relationship between stress (depressive symptoms and resilience. Additionally, high neighborhood strain (low cohesion) is positively correlated with depressive symptoms. As for resilience, we find that risk behavior, suicidal behavior, a less affectionate parent-child relationship, and low religious engagement are negatively associated with resilience. Moreover, we find a negative relationship between high levels of perceived neighborhood strain and adolescents' resilience for environmental characteristics.

For the age and child gender, the descriptive findings correspond with previous work on resilience and mental health, showing a negative relationship for girls and depressive symptoms, and a negative relationship for older children and depressive symptoms (Anyan and Hjemdal 2016). In comparison, resilience is negatively associated with younger male children.

Table 2. Correlations among Depressive Symptoms and Resilience and other Personal and Environmental Characteristics (N−6,446)

	Depressive Symptoms	Resilience
Depressive Symptoms	1.00	-.585***
Resilience	-.585***	1.00
Risk behavior	.127***	-.167***
Suicidal Behavior	.302***	-.316***
Warm relationship with parent	-.215***	.305***
Neighborhood strain	.182***	-.525***
Age	.056**	-.093***
Sex	.114**	-.060***
Religion important	-.034*	.107***

*** Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).

Next, present the findings of the regression analyses in four models. The results in Table 3 Model 1, show that high levels of resilience decrease depression symptoms in adolescents. This direct relationship has also been established in other studies (Anyan and Hjemdal, 2016; Cole et al., 2014; Tram and Cole, 2000). As for personal characteristics, age does not show a significant effect on the outcome measure. However, in support of previous research, we also find that female adolescents have higher depression symptoms than their male counterparts (Plickert and Pals, 2019).

The third model examines the effects of risk behavior in the presence of resilience. We find that suicidal behavior over less dangerous risky behavior is strongly associated with higher levels of depression. However, less risky behavior has a small but still significant effect on depressive symptoms. The inclusion of risk behavior and suicidal behavior

increases resilience-based differences in depressive symptoms. These interrelationships contribute to differences in the size of the resilience coefficient from -.347, -.344 to -.317 across models 1, 2, and 3.

The final model assesses the effects of neighborhood strain (e.g., low cohesiveness), quality of the parent-child relationship, and a child's religious engagement. We find that high neighborhood strain heightens adolescent depressive symptoms, while positive parental relationships and religiosity potentially protect from depressive symptoms. Stress and resilience predict depressive symptoms by showing a positive relationship between stress and depressive symptoms and a negative relationship between resilience, religion, and positive parenting.

Table 3. Regression of Depressive Symptoms, Resilience, Risk Behavior, and Supportive Personal and Environmental Factors

	Depressive Symptoms Model 1	Depressive Symptoms Model 2	Depressive Symptoms Model 3	Depressive Symptoms Model 4
Resilience	-.347***	-.344***	-.317***	-.366***
Age	—	.006	.008	.010
Child Gender	—	.307***	.292***	.260***
Suicidal Behavior	—	—	.716***	.682***
Risk Behavior	—	—	.066***	.054***
Warm parent relationship	—	—	—	-.069**
Neighborhood strain	—	—	—	.306***
Religion	—	—	—	.075***
Constant	9.431***	9.111***	8.570***	8.766***
Model R²	.340	.344	.360	.380

Source. AddHealth Public-use data wave 1

For the next steps of the analysis, we propose examining interaction effects between resilience and other child stressors. A significant interaction between these concepts would support the assumptions of resilience operating in protective ways – supporting the hypothesis of handling adversities.

Longitudinal Approach

We also examine resilience as a process by applying a life course approach. We employ multilevel growth curve models (see also Singer and Willett 2003) to analyze trajectories of resilience and neighborhood strain and parental stress during adolescence. Methodologically we can separate within-person differences from between-person differences, therefore controlling for the effects of unobserved heterogeneity that may affect differences in resilience and other stressors across adolescents. That means more precise estimates of neighborhood strain and parental stress on changes in resilience across trajectories of adolescents are estimated (Lee, Wickrama, O'Neal, and Lorenz 2017, Raudenbush and Bryk 2002, Singer and Willett 2003).

Figure 1 illustrates that early experiences of high neighborhood strain and parental stressors act in concert and show low adolescent resilience. However, resilience seems to be differently affected by each of the stressors, implying that the experience of high parental stressors but low neighborhood strain still promotes increases in resilience from adolescence to young adulthood. Thus, strain and stressors experienced in early adolescence generate differences in resilience in young adulthood. We also find that in early adolescence, when children begin to choose and manage some of their own decisions in their daily lives, that resilience represents a process of interacting with these developmental stages.

FIGURE 1. Effects of Neighborhood Strain + Parental Stress on Resilience over time
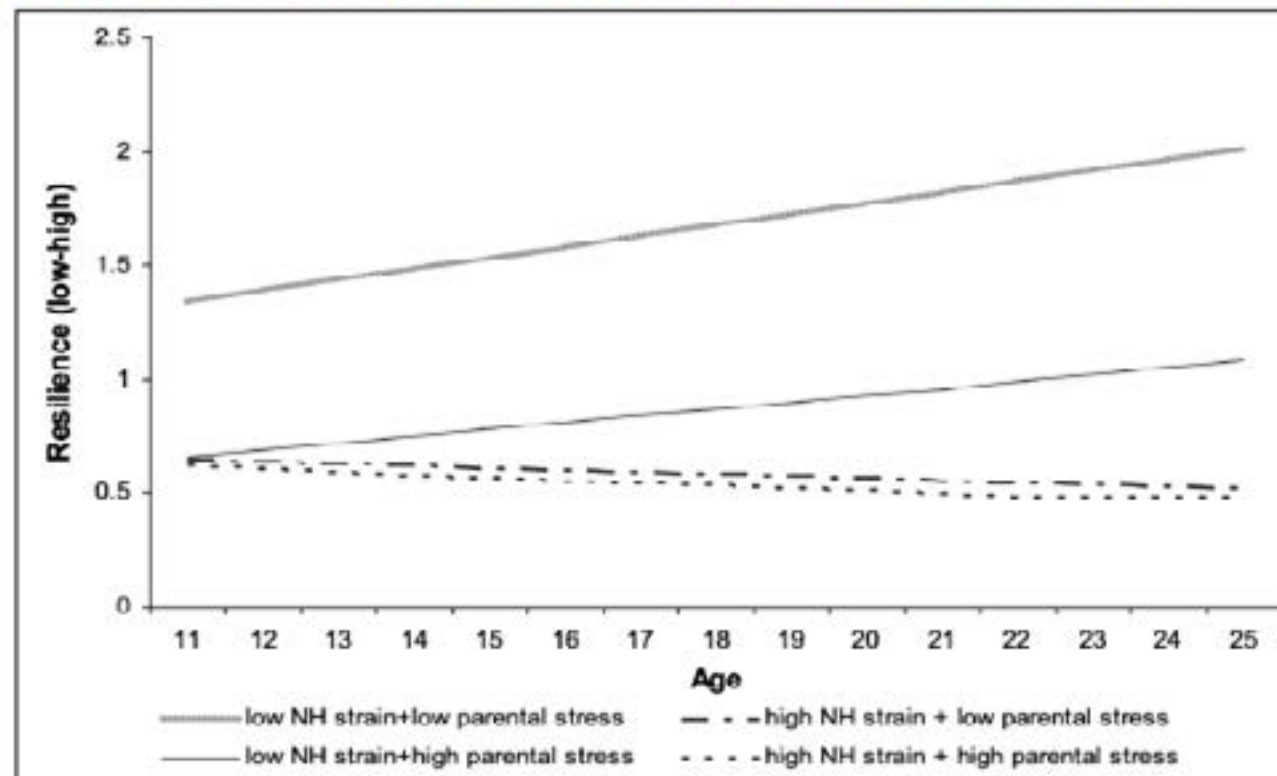
Conclusion

The concept of resilience underscores how interrelations of personal attributes, environmental characteristics, and developmental pathways explain adolescent resilience. We find that resilience reduces mental disorders. Some personal attributes may have only short-term direct effects on adolescents' wellbeing; however, the life course approach suggests that persistent external experiences (parent-child relationship, quality of neighborhood one is living in) contribute to differences in adolescent degrees of resilience. It is vital to take into account the interplay of these dimensions to determine potential short-or long-term effects that promote resilience throughout the development stages of children.

In light of these preliminary findings, we also acknowledge some limitations. First, the scales for depressive symptoms and resilience follow established scales from psychology and social science research; however, the list of items to include was limited for both scales.

We do acknowledge that the information is drawn from self-reports. We, therefore, apply a measure of depressive symptoms instead of depression. For future research, a clinical measure of depression might further inform us about the interplay of resilience and mental health.

Second, the scale of resilience adapted responses that closely matched the Resilience scale READ (see Oshio et al., 2003). However, the current data does not offer the range of measures that could capture resilience in ways of novelty seeking, emotion regulation, and positive future orientation. Our measure only includes items that correspond to positive future orientation as part of resilience. The longitudinal analysis has provided a snapshot of resilience as a process.

The need for items of resilience to be measured into adulthood is a necessary step to expand our understanding of changes in resilience in response to adverse experiences or circumstances.

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Can Men be Oppressed as Men? Lessons from Intersectionality

Introduction

In 1964, the Civil Rights Act was passed along with the Title VII provision that prohibited discrimination by employers on the basis of race, color, religion, sex, or national origin.[1] Title VII was championed by African American attorney Pauli Murray. In a speech to the Senate, Murray argued: "both Negro and white women will share a common fate of discrimination, since it is exceedingly difficult for a Negro woman to determine whether or not she is being discriminated against because of race or sex. These two types of discrimination are so closely intertwined [sic] and so similar that Negro women are uniquely qualified to affirm their interrelatedness"[2] However, with time, Title VII's original intentions to protect black women's experience was altered to fully focus on pure forms of discrimination. The unique experiences of women of color faded as Title VII was "white washed" by white feminist activists who sought to universalize the definition of sex discrimination. As Serena Mayeri writes,

> "Putting a white face on feminists' agenda increasingly seemed expedient, especially to advocates intent on building coalitions to resist the headwinds of an increasingly conservative political climate… In Title VII cases and in sex equality law more generally, discrimination claims' origins in the experiences of black women and in the intersection of race and sex often gave way to a focus on "pure" sex discrimination, untainted by the complexities of intersectionality" (Mayeri, 2015, XX)

By the 1980s, the Court explicitly rejected intersectional discrimination and favored "pure" forms of discrimination. The Courts in Moore v. Hughes Helicopter, DeGraffenreid v. General Motors, and Payne v Travenol ruled against the black women plaintiffs and rejected their complex forms of discrimination. Following this, Kimberle Crenshaw wrote her landmark piece titled "Demarginalizing the Intersection of Race and Sex". In this piece, Crenshaw heavily critiqued the Courts' pure discrimination interpretation and demonstrated how black women of color were relegated to the margins. Moreover, black women had no recourse in Title VII because of how narrowly Courts construed the definitions of discrimination. It is here where Crenshaw coins the term "intersectionality". As Crenshaw writes, "Black women's experiences are much broader than the general categories that discrimination discourse provides. Yet the continued insistence that Black women's demands, and needs be filtered through categorical analyses that completely obscure their experiences guarantees that their needs will seldom be addressed" (Crenshaw, 1989, 149-150).

Though the term was coined in that landmark piece, intersectionality has a long history rooted in black feminist and latina feminist thought with earlier instances of intersectional thought in Sojourner Truth's "Aren't I a woman?". Intersectionality is derived as a form of resistance against dominant frameworks in gender theory that failed to include the lived realities of women of color. These frameworks modeled sexism as discrimination against white women and racism as discrimination against black men, too often leaving the unique experience of black women ignored altogether or theorized as the sum of sexism

and racism. This method of theorizing discrimination failed to accommodate the distinct ways women of color experienced their lived realities and contributed to their further marginalization. As Audre Lorde wrote, "the oppression of women knows no ethnic nor racial boundaries, true, but that does not mean it is identical within those boundaries. Nor do the reservoirs of our ancient power know these boundaries, either. To deal with one without even alluding to the other is to distort our community as well as our difference" (Lorde, 2015, 93).

Since then, the term "intersectionality" has been used in various ways and for various reasons and in many times without consensus. Some theorists have claimed that "intersectionality" shows us how "race, class, and gender mutually construct one another" (Collins, 2003). Others have theorized intersectionality to only encompass forms of "structural oppression". Some extend intersectionality to claims of psychological and epistemic oppression to complicate feminist standpoint theory in which the distinctive experiences of oppression of individuals who occupy multiple disadvantage social positions gives them privileged epistemic standpoints.

As intersectionality has gained strength and momentum, it started being used by different groups of people to understand and their unique experiences. Importantly, intersectionality was used as a way to understand the experiences of men of color and to theorize whether or not they could be oppressed as well. However, many recent scholars have objected to the use of intersectionality in understanding the oppression of men for various reasons including that it is unable to encompass the complexities of gender and race as whole.

We argue (1) intersectionality teaches us that this is an instance of oppression of men as men; (2) certain models of intersectionality implicitly hold problematic assumptions that obscure the way certain men are targeted; and (3) modeling intersectionality itself in a methodological way, as a "heuristic device", "analytical lens" or "regulative ideal" is better equipped to handle complex and nuanced questions. Ultimately, if we take seriously the implications of this model of intersectionality, then men can be oppressed qua men.

Recent Critique to Intersectionality
1. Objection 1: De-centering Black Men

Intersectionality has long been a target of critique because of its long history and no single origin point. Most recently, however, scholars have taken aim to intersectionality as being unable to fully encapsulate the oppression of subordinate men—namely, men of color. This objection tracks one line of intersectional thought that objects to the travelling of the theory away from the experiences of black women. Namely, because intersectionality is meant to center discussions of oppression and injustice on the experience of black women, all other forms of intersectional discrimination flows in and through this experience. Problematically, Curry argues that this way of formulating intersectionality renders black masculinity "irredeemable through its own faculties" (Curry, 2017, 200-201) and forces black masculinity to be altered through a black feminist ethics rather than an honest inquiry into the unique ways black men are oppressed because of their race and gender. As such, intersectionality becomes less of a methodological tool to inquiry but rather a framework in

which all other forms of discrimination are compared to.

Reply

      Curry's objections do hold some weight as they track certain interpretations of intersectionality. Most notably, Nikol Alexander Floyd explicitly objects to the traveling of intersectionality beyond the lived experiences of women of color. As Nikol Alexander-Floyd argues, "the commitment to centering research and analysis on the lived experiences of women of color for the purpose of making visible and addressing their marginalization as well as an ethos of challenging business as usual in mainstream disciplines' habits of knowledge production" (Alexander-Floyd, 2012, 9). If intersectionality really is to only highlight the experiences of women of color, then intersectionality would not be the best model for studying the gender oppression faced by black men. Similarly, the Combahee River Collective writes, "if Black women were free, it would mean that everyone else would have to be free since our freedom would necessitate the destruction of all systems of oppression" (Combahee River Collective, 1977). The suggestion here is that black women, as multiply disadvantaged by race and gender, are at the bottom of the power hierarchy. So, in order to fully understand oppression, it must be in and through the experiences of black women. Centering on women of color often can be an incredibly powerful tool as an antidote to existing androcentric and ethnocentric trends in discourse.

      Curry is not the only theorist that has objected to the centering of black women implicit in intersectional analysis. As Athena Mutua argues in "Multidimensionality is to Masculinities what Intersectionality is to Feminism", "the idea that intersecting social systems are mutually reinforcing had been expressed earlier, both as a potential clarification of intersectionality and a critique. But, to my mind, this idea had been implicit in the original articulation of intersectionality theory and/or absurd by it That is, though the focus in intersectional theory had previously been on the intersection of two subordinating structures (e.g. race and gender in the context of black women), the suggestion had been that race shaped gender and gender shaped race at the intersection to create unique experiences for groups like black women" (Mutua, 2013, 348). In other words, because the original intentions of intersectionality was to highlight the ways women of color faced unique discrimination, it could not fully theorize the experiences of men of color without facing severe criticism for traveling of the term. In fact, though Mutua is emptying an intersectional framework to demonstrate the unique experiences of men of color, she explicitly rejects using the term 'intersectionality" as it should only be for feminist inquiries. Rather, she coins the term "multidimensionality" to be used to inquire about masculinities. As she writes, "the multidimensional framework…appeared to allow scholars to map the internal and external structures that shaped men's experiences. [It] thus complemented and informed masculinities theory, and vice versa" (Mutua, 2013, 360) Ultimately, however, intersectionality and multidimensionality employs the same methodological framework with just different names.

      However, projects need not center on women of color to be intersectional and many projects don't. Multidimensionality is inherently an intersectional project that focuses on men of color. By employing the methodological commitment of intersectionality, we find all kinds of intersectional research finding different effects in a variety of social scientific projects and

many with surprising results. We would expect discussions of black masculinity to be continuous with at least some black feminisms, not because these feminisms center on black women, but because by centering on black women they are getting revealing obscured truths about the social world.

2. Objection 2: From Colonizing Logics

      Other scholars like Maria Lugones, took aim at intersectionality for its continued use of the gender categories "man" and "woman". Lugones is critical of these social categories as she believes that race and gender and intimately intertwined through colonial logics. As such, continued use of these terms in order to theorize oppression not only obscures unique experiences but perpetuates these logics. Importantly, Maria Lugones in "Radical Multiculturalism and Women of Color Feminism" argues that contemporary theories of gender categories fail to address how gender was formulated through a colonial system. Lugones argues,

> "there has been a persistent absence of a deep imbrication of race into the analysis that takes gender and sexuality as central in much white feminist theory and practice, particularly feminist philosophy. I am cautious when I call it 'white' feminist theory and practice. One can suspect a redundancy involved in the claim: it is white because it seems unavoidably enmeshed in a sense of gender and of gendered sexuality that issues from what I call the light side of the modern' colonial gender system. But that is, of course, a conclusion from within an understanding of gender that sees it as colonial" (Lugones, 2011, 76).

      In other words, Lugones tracked how contemporary gender theory failed to incorporate how gender was constructed through race for people of color. "Women" for Lugones, is synonymous with white women and although, it is theorized to be a universal social category, it manages to erase how that category was created through race. More importantly, Lugones argues that it creates two separate genders where those on the 'light' side (i.e. white women) constructs gender theory and marginalize and oppress those on the "dark" side (Lugones, 2007, 207). In Lugones' fiercest critique, she takes on Sojourner Truth's famous question "Ain't I a woman" and responds, "thus, the colonial answer to Sojourner Truth is clearly—no" (Lugones, 2011, 75). Lugones takes this to also be a significant problem for intersectionality as it fails to take into account the relation between colonization and radicalized gender oppression that has affected how we view the social categories (Lugones, 72). As she writes, "the lack of clarity has made our relation to decolonize positions difficult. I am complicating the understanding of radicalized gender, going beyond intersectionality, by introducing what I call the colonially of gender and moving forward a decolonial feminism" (Lugones, 72).

      Lugones explicitly rejects that social categories (such as race and gender) can be neatly separated out. She charges intersectionality with perpetuating hegemonical mainstream gender categories rather than taking a nuanced approach. As Lugones writes, "recognizing the categories of subjection does not take us far enough, because the problem is specifically political. The solution does not merely entail arguing for the multiplicity of identities or challenging essentialism generally. Any discourse about identity

has to acknowledge how our identities are constructed through the intersection of multiple dimensions" (Lugones, 75). She further argues, "the categories and categorical thinking are tools of oppression. Oppression cannot be erased conceptually. It is not a mistake to presuppose categories of oppression in understanding intersectionality. It is indeed necessary. For the phenomenon that is being explained is precisely the ignoring of multiplicity through categorical seeing that cannot countenance those who live at the intersection of more than one category of oppression" (Lugones, 75). Lugones takes this to be an internal inconsistency within intersectional theory. She argues that intersectionality presupposes static and monolithic gender categories which then intersect within a person to create their unique social position. However, theorizing gender categories this way still perpetuates a pure and universal understanding of gender categories. As she writes, "presupposing the categories of oppression to be separable, is to accept fundamental presuppositions of both racism and gender oppression. But the acceptance is for the purpose of superseding the separation" (Lugones, 75). In other words, how intersectionality operates is to assume fundamental truths about racial and gender oppression; yet, intersectionality is meant to complicate these truths. However, it would be impossible to resist or fix any of these issues if on its face, we assume that they are true. Moreover, continuing to advance "interlocking" forms of oppression would entail taking on broad social fragmentation which to Lugones is an ideological mechanism to fragment complicated, multiplicituous beings. As she writes, "the categorical training of human beings into homogeneous fragments is grounded in a categorical mind frame. Interlocking is possible only if the inseparability of oppressions is disguised. Everywhere we turn we find the interlocking of oppressions disabling us from perceiving and resisting oppressions as intermeshed or fused" (Lugones, 76).

As such, Lugones prefers to reject intersectionality as a whole and substitute it with a framework that recognizes the fusion or intermeshing of oppression (Lugones, 76). Because gender, race, and sexuality are so intimately tied together, Lugones argues it is impossible to theorize one without the others. By viewing these categories to not be separable but to be fused or intermeshed, then we come up with more than just two genders. As Lugones writes, "it is not that femininity and masculinity are two sets of characteristics that constitute 'man' or 'woman' Rather, females radicalized as non-white are not of the same gender as white females" (Lugones, 76).

Reply

Intersectional theorists disagree about how to conceive the categories themselves. Lugones' objection tracks one form of theorizing intersectionality; namely, what Gasdaglis and Madva term the "metaphysical co-constitution thesis" (Gasdgalis and Madva, 2020). However, by embracing this interpretation of intersectionality, all social categories mutually construct one another and faces a classical regress problem. At worst, it entails a dissolution of social categories altogether.

Yet, intersectionality need not be theorized in this matter. If Lugones only means to suggest that we need a plurality of genders to fully represent indigenous peoples, intersectionality as a method, can be open to this. Two years after "Demarginalizing", Crenshaw published "Mapping the Margins". In this piece, Crenshaw takes on post-

modernist/anti essentialist critiques and warns that intersectionality should not be used as a "totalizing theory of identity" nor that intersectionality should only be used to ascertain different experiences based on gender and race alone (Crenshaw, 1991, 1244). Crenshaw makes a conscious choice of specifically delineating how intersectionality should be used: as a methodological tool for inquiry. Specifically, she argues that intersectionality should be used in all areas of theorizing the different ways social categories interact, shape, and inform access to social and political structures. As Crenshaw writes, "intersectionality might be more broadly useful as a way of mediating the tension between assertions of multiple identity and the ongoing necessity of group politics" (Crenshaw, 1991, 1296). Importantly, Crenshaw explicitly rejects anti essentialist arguments that call for the elimination of social groups entirely. She argues that the world operates in social categories and it is valuable in not only recognizing how these social groups interact but also provides value in how a person sees and positions herself in the world. Crenshaw argues, "recognizing that identity politics takes place at the site where intersect thus seems more fruitful than challenging the possibility about categories at all. Through an awareness of intersectionality, we can better acknowledge and ground the differences among us and means by which these differences will find expression in constructing group politics" (Crenshaw, 1991, 1299). Ultimately, Crenshaw alludes to a possible redefinition of social groups to bring to the forefront the voices of those living in the historically erased intersections of social group politics. Perhaps Sojourner Truth's point is to resist ceding the category "woman" to the dominant white perspective, a goal that Lugones strives for as well. Our view is that we should apply intersectionality from the ground up, in conceiving of the social groups and categories themselves.

3. Objection 3: From Hegemonic categories

The last objection our paper will consider is from hegemonic categories. Tommy J. Curry in The Man Not argues that intersectionality inherits conceptions of gender and race from certain strands of feminist scholarship. These strands fundamentally define masculinity as privileged. As he writes, "in the work of intersectionality theorists all masculinity tends towards domination and subjugation. This is an essential nature found in the category male" (Curry, 2013). As such, intersectionality theorizes the oppression of men of color as only racial oppression rather than their oppression being complicated by their gender as well. Internal to these passages is a metaphysical assumption about the nature of gender categories and how they are constructed through a certain way of thinking about oppression. In other words, what it means to be a man is to be dominant and privileged in a certain way relative to women and what it means to be a woman is to be subordinate in a certain way relative to men.

2. Metaphysical Assumptions about gender and oppression

Many models of intersectionality do take these metaphysical assumptions on board. For example, Audre Lorde writes, "…it is easy for Black women to be used by the power structure against Black men, not because they are men, but because they are black" (Lorde, 108). Kimberle Crenshaw when she first formulated intersectionality, theorized intersectionality as such:

"Imagine a basement which contains all people who are disadvantaged on the basis of race, sex, class, sexual preference, age and/or physical ability. These people are stacked-feet standing on shoulders-with those on the bottom being disadvantaged by the full array of factors, up to the very top, where the heads of all those disadvantaged by a singular factor brush up against the ceiling. Their ceiling is actually the floor above which only those who are not disadvantaged in any way reside. In efforts to correct some aspects of domination, those above the ceiling admit from the basement only those who can say that 'but for' ceiling, they too would be in the upper room" (Crenshaw, 1989, 151)

Therefore, when conceptualizing the oppression of men of color, theorists suggest that intersectionality entails that the forms of racism a black man encounters differ in some ways from those a black woman encounters as a consequence of black men's gender privilege and black women's gender oppression...via intersectionality, other examples, such as police violence against black men, can similarly be understood as gender-specific instantiations of race oppression rather than as instantiations of the oppression of men qua men. This debate in masculinity studies has roots in feminist theories by way of Sally Haslanger's metaphysics of gender and race. On Haslanger's view privilege and subordination are intrinsically built into the very meanings of the categories of man and woman. Consequently, being a man is always privileging and being a woman is always subordinating. Similarly, being white is always privileging and being black is always subordinating. In this model of social categories, the interaction or confluence of social categories is modeled in mere arithmetic terms:, when "blackness" is added to "maleness", the total privilege a black man holds is reduced by some indeterminate quantity. Thus, men regardless of race, are always privileged along the dimension of gender.

In adopting Haslanger's metaphysics of gender and race, Higgins is led to the conclusion that instances of disadvantage can be only racial oppression. Higgins concedes that there is a "wide variation in the capability of men" but explains this as a "group [that] is intersected by other social groups."

3. Bi-polar model of oppression is overly reductive

Because we've built this into our definitions of gender categories, we can know claims of gender oppression a priori. As Curry writes, "black masculinity has become the name of these analytic truths in many regards To say a racial account is 'masculinist' or that a phenomenon originates from Black masculinity is to suggest that the maleness operating in the construction is condemnable. This ontology of Black masculinity is deathly allergic to empiricism; thus, it avoids historical, psychological, and sociological accounts of Black male life in America" (Curry, 201). It becomes that real empirical, statistical truths, grounded in real observations are turned into necessary truths through a theoretical process of definition and legitimate critical work becomes hegemonic and essentialist. Maria Lugones was on to a similar problem when she described the thickness vs. thinness of people in a social group. As she writes, "the interlocking of memberships in oppressed groups is not seen as changing one's needs, interests, and ways qualitatively in any group but, rather, one's needs, interest, and ways are understood as the addition of those of the transparent members" (140). In other words, if social groups are conceived as monolithic, the desires

and needs of the dominant members of the group becomes the very definition of the social group. All others are lumped into the same category without room for complexity or nuance. In order to support these claims, many theorists use Iris Marion Young's model of oppression. However, Young's own model does not require this bi-polar relationship. As she writes, "the systemic character of oppression implies that an oppressed group need not have a correlate oppressing group" (Young, 41). In other words, for a group to be oppressed we do not need to identify a parallel oppressing group. Rather, a group can be oppressed in relation to a structure or to another unrelated group. She explicitly writes, "fact not all men are equally privileged by gender" and that "some women are privileged in relation to some men, a privilege that derives partly from gender" (Young, 1994, 720). Here, she explicitly rejects the notion that all men are privileged by gender and all women are subordinated by gender. She leaves room for nuances especially where other forms of identity interact to create more nuanced distribution of privilege and oppression. She also cautions us in comparing opposing group's privilege and subordination. As she writes, "a working-class woman's gendered experience and oppression is not properly identified only by comparing her situation to working-class men. Much of her gendered experience is conditioned by her relation to middle-class or ruling men" (Young, 1994, 720). This is important especially because it is in direct conflict to models of intersectionality that formulate privilege and oppression by comparing it to seemingly equal groups. This is especially frustrating when we try to theorize the oppression of men of color. For example, Higgins endorses that premise that "men are a privileged social group" because the group members have "uniformly high capabilities." Yet, when discussing the disadvantage of undocumented immigrant men, he argues,

"whether the group member is privileged or disadvantaged, considered as a member of that group, can be determined only by comparison to the capabilities of people who belong to the same set of social groups, save the one in question. For example, to determine whether undocumented immigrantmen are disadvantaged qua men, their capabilities must be compared to women who are undocumented immigrants"

In other words, in order to determine whether Latino men are disadvantaged, there is a requirement to compare them with their female counterpart rather than seeing the unique ways undocumented immigrant men can be disadvantaged because of their gender, race and citizenship status. If Higgins political aim is to evaluate how certain institutions constrains group members, for example immigration policies, then holding an essentialist view that the category "man" is always privileging occludes the actual experiences of men of color where oppressive practices are not only racialized but gendered as well. Curry makes a similar objection by arguing, "gender, then, becomes a placeholder for the assumed sexual dominance of man over woman rather than a contextual rendering of various differences and the consequences of those differences on bodies and historical relations between those bodies" (Curry, 204).

As such, we think its plausible that "for every oppressed group there is a group that is privileged in relation to that group" but we doubt that the privileged group will always be, or should always be conceived as, the other pole of the social group axis (Young, 42). However, the question is then "must intersectionality model "privilege" and "oppression"

as two poles along a single group axis?" Although the metaphor of the intersection might suggest this, Kimberle Crenshaw's formation of intersectionality does not explicitly suggest this. Rather, intersectionality should be applied as a method as she says in her TED Talk, "I'm not really an academic, I just play one on TV. What I really am, is a problem solver…I look for social injustices that don't have a name, and language makes things visible. Language is composed of categories. We need a framework to interview in our language and ways of knowing. I don't know what to say about the theoretical aspect of the criticism, but I do know one thing: I'm not concerned about the theory. I look at the applications, how things work on the ground. In the communities I'm in, and for the people I work with, intersectionality works. So, until those people come to me and say they're worked I'm 'imposing categorical logics' on them, I'm going to continue advocating for intersectionality (Crenshaw, 2018).

Curry's objections only stand on some models of intersectionality but not all. As Olufemi Taiwo writes, "first, if it is true that being male is theorized by intersectionality theorists as inevitably and in principle bound up with privilege across the racial spectrum—as Curry alleges—then intersectionality as a concept, theoretical approach, or 'sensibility' is no defense of or even explanation of this tendency, and intersectionality adherents and sympathizers have themselves explained why. Then, Curry's dispute with intersectional theorists should be understood like his dispute with social scientists: the dispute is less about the tools themselves and more about what they are used to do" (ibid, 9).

4. Intersectionality as a Regulative Principle

Intersectionality is not itself a general theory of social group that applies as a "universal law" to social reality. It is not a metaphysical thesis about the essential nature of identity, discrimination or oppression. Instead, it is a principle that tells us how to go about looking into oppression and social reality in all its detail and specificity. It tells us to "ask the other question" or how to look, not a theory of what we will find. As such, the intersectional maxim is "treat existing categories as if they are indefinitely mutually informing, with the aim of resisting inequality and injustice" (Gasdaglis and Madva, 2020). Social reality is an ongoing historical process and they change and evolve with time. Intersectionality can be one maxim for an ongoing process of social critique and investigation into the social world that applies to the way we theorize, critique, and re-theorize oppression and social reality over time. Given that social theory can itself be a source of subordination and marginalization, intersectionality as a maxim is a call to be ever-vigilant in our critique.

5. Conclusion
As a method for inquiring into oppression in all its detail, it can say 'yes' in a variety of different ways, in a variety of different contexts. Men of color are targeted with gender violence in a variety of different contexts. To reduce this to a "gendered-instantiation of racial oppression" is to treat it as an analytical truth that being a man is something that all men have going for them, in general and all the time. This just is to adopt a hegemonic meaning of the category "man" as colonial patriarch: one that is white, wealthy, able-bodied, cis and straight. There are other significant implications in this way of theorizing social groups, intersectionality and oppression. It can obscure real debates on xyz. (Socially Undocumented)

[1] See, 42 U.S.C. § 2000e-2

[2] Murray, Title VII Memorandum, supra note 23, at 20

[3] "The Intersectionality wars"

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Abstract

Millions of students enroll in college each year from diverse backgrounds. One in five students make up the population of student parents. My research focuses on the different ways first-generation Latina Student parents are juggling work, school and family life while trying to fulfill U.S expectations and heritage expectations. To conduct my research, I am doing a meta-analysis while using the symbolic interaction theory. Using the framework of Erving Goffman the Presentation of Self and Arlie Hochschild Managed Hearts I was able to analyze how role strain, role conflict and microaggression affect the everyday lives of Latina student parents.

Theoretical Framework

The symbolic interaction theory is a framework that focuses on analysing the patterns of communication, interpretation and adjustment between individuals in society through the meanings of symbols. I looked at the looking glass self which is a social interaction that explains the sense of one's self and self-esteem and how it is built off of others. The looking glass self refers to our ability to think about how other people with think about us we imagine how we appear to others, the judgement of our appearance and this creates the "self".If we look at particularly moms they create this identity based on the ideologies of others.Two sociologists who shaped my analysis are Arlie Hoshcild and Erving Goffman.

Erving Goffman uses the concept of the dramaturgical model which is the way he viewed society and individuals. He believed the world was a stage and individuals were all actors. Goffman talks about a front and a backstage. The front stage refers to how we act around others and the front stage is how we act around ourselves. With remote learning the front and backstage are rather difficult for student parents because unlike when classes were in person now the front and backstage do not exist and are merged together.Student parents have to be online for their classes but they also have to present with their children. It shows how the status of being a parent and the status of being a student collide.

Arlie Hoschild talks about Emotional Labor,the process of keeping all your emotions and expressions because of expectations. It's this notion of being a super-mom, or the saying of "fake it until you make it". Women do emotional labor all the time. They are expected to juggle work,school, family and all these other roles and expected to not feel overwhelmed, not feel stressed,upset. They are expected to hide all of these emotions which is unhealthy because these emotions are natural and as individuals we have to normalize that. It is okay to not be a "perfect mom" and break down because you're stressed, it is okay to take care of yourself because it's a form of self-care. What is not okay is keeping in all these emotions because of fear of argumentations or because of fear of what society has to say.

The notion of "being a good mom" is a westernised ideology. According to scholars a "good mom" is someone who puts the children first,provides for the children, keeps them out of trouble and keeps the children safe(McCormack 2005).A "good student" is someone who prioritizes school,has good academic performance, has commitment and effort and is involved on campus (Koljatic et al. 2001).These defentions allow individuals to view the standpoint of what a "good mom" and a "good student" are in the eyes of society and how student parents are juggling to met expectations.

When talking about student parents individuals have to take into consideration role strain and role conflict. Role strain is when an individual struggles to fulfill the expectation of a single status.For example, in this study role strain would refer to the stress experienced by a woman because she cannot comply or has difficulties complying with role expectations. Role conflict is when different statuses that are held within a person collapse together. For example, the status of being a mom can intersect with the status of being a student.

Literature Review:

Stigma

Research shows the different obstacles student moms go through when juggling school,family and work.One of the challenges highlighted by scholars is stigma .According to Erving Goffman there is three main types of stigmas one associated with mental health, one associated with physical deformation and the one associated with this research which is associated with the identification of race,ethnicity,religion,social class,(Goffman 1963). Scholars who have studied parents have found that many of the participants have highlighted how they are not the "ideal" college student and stigmatized by others because they are young mothers.Adrianna was a 34 year old first-generation, low-income student parent who was interviewed and stated that she felt alienated when visiting a college with a child in tow, describing how, as a poor Latina mom, she was "out of order" on the campus and mentions how administrators and professors don't expect students to have children."(Dodson & Deprez 2019). Adriana is one of many student parents who feel this sense of alienation. Being "alienated" makes individuals feel inferior and "othered" it ties along with the notion of not belonging. Lupe, an 18-year-old mom, mentioned how she felt judged by others because she was a young mother, she felt like to others she was not responsible and that she didn't have proper resources (Navarro-Cruz et al.2020). These negative experiences amongst Latina student parents is not the only challenge that this population faces.

Academic and Social Factors

Amongst stigma many Latina student parents come from low-income backgrounds and this creates an additional stressor. According to the Institute for Women's Policy Research, more than eight times as many women as men work in occupations with poverty-level wages.This shows the struggle that women go through each day, yet alone student moms have an additional stressor. In Dr.Navarro-Cruz's qualitative study she mentions how one the reasons for college dropouts in latina student parents was because of lack of finding a proper childcare that met their needs. Mothers explained how the programs that did meet their needs were too expensive. When deciding which childcare to pick, trust played

the biggest role because mothers want to feel safe, they want their children to be in the best hands which is why most of them stated that they would prefer to take care of the children by themselves due to trust. During the interviews, mothers stated that finding a balance between the type of childcare they wanted versus being financially stable was a big issue and many of them planned ahead. Some of the mothers decided to not work, others took on part-time jobs and others switched shifts because they did not find the appropriate child care center that they trusted and felt comfortable with. This shows how these mothers struggle with role conflict. It is stressful to combine work and family life apart from planning ahead. For example, what are the children going to eat, what are they going to play. This connects to Arlie Hoschilds Managed Hearts because it shows how women must take on an extra shift and at times must sacrifice it all for their little ones.

Sheila Katz researches student parents and mentions how poor moms raising children represent "one of the few contexts in modern American life in which education is explicitly discouraged."Why is that student parents are brought down by society instead of encouraging women to pursue a better future not only for themselves but for their children. Alison lives the constant juggle of work, family, and state regulation as she pursues her degree she mentions "If I don't work enough, I lose childcare [assistance] but I have to fit all my classes in and studying and the job Just don't get sick,' I say that in my head all the time to my child. 'Just don't get sick.' But guess what? Kids get sick" (Dodson & Deprez 2019). This is the constant struggle student moms go through each day. They have to juggle between the different statuses that they have. For example, as student parents the different status that exists amongst them can be the status of being a mom, student, partner and an employee. There's this constant juggle that student moms cannot avoid. Lupe who is a young mom of 18 mentions how before she is Lupe, she is a mom (Navarro-Cruz et al.2020). During the pandemic, many student parents were affected by remote learning.

Familism

Familism "According to Ernest W. Burgess and Har- vey J. Locke, ideal-typical familism refers to strong in-group feelings, emphasis on family goals, common property, mutual support, and the desire to pursue the perpetuation of the family"(Bardis 1959). Familism is tied to the Latino cultural value system. Familism has many positive aspects that have impacted the lives of Latina student parents. In a published article by American Sociological Association a study done by Diaz and Nino shows how Hispanics who report stronger orientations toward familial support have significantly fewer depressive (incidence rate ratio [IRR] = .94) and anxiety symptoms (IRR = .97) than those less inclined to agree with such sentiments. This shows the importance of having family support especially amongst first-generation Latina student parents. Many student moms advocate that there biggest support system was there families.

Implications

Research on Latina student parents is necessary because the number of Hispanics in the CSU system is growing each year. Twenty three out of twenty-five CSUs are Hispanic Serving Institutions. These schools must take into consideration that more than half of the students are females and several of them are student parents. Campuses need to take this issue seriously and they need to implement more support for this growing population, there needs to be more than one organization on campus that focuses on student parents.

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Walton   **Locke's Theory of Property**
Alexander

Abstract

This paper investigates applying Locke's theory of property, as stated in his Second Treatise, to intellectual property and its incompatibility with regard to current U.S. intellectual property law. I begin by modelling possible metaphysical positions of the intellectual commons, including Nominalism and Realism. I then argue that intellectual property can easily pass Locke's Enough and as Good provision, due to its non-rivalrous nature, and his Waste provision—responding to arguments made by Hettinger (1989) and Damstedt (2003)—by appealing to future possible uses making waste implausible. I then consider whether the rights granted to intellectual property include the right to exclude others and do not find an answer based in Locke's text. Afterwards, I show that the expiration dates of copyrights and patents are unjustified under Locke's theory because property rights are indefinite unless the property is wasted. I also show that the exclusion of independent work for patents is also unjustified. Finally, I conclude with a brief thought regarding how Utilitarianism would also not be compatible with the current intellectual property law.

Introduction

John Locke has been very influential in how the United States views the government and the law. The unalienable rights of "Life, Liberty, and the Pursuit of Happiness" in the Declaration of Independence come almost directly from Locke.[1] One of Locke's most well-known contributions to political philosophy is his attempt to justify private property in his Second Treatise of Government. While Locke's theory was understandably focused on physical property, such as land, there's a question of whether it can also justify private intellectual property. Also, with his influence on our government, it raises the question about whether our current intellectual property laws are justified under his theory. In this paper I will argue that our current intellectual property laws are not fully justified by Locke's theory of property and will try to provide some guidance as to what Lockean intellectual property law would look like. The purpose of this paper is not to argue that intellectual property laws should be changed in light of Locke's theory. Nor is the purpose to argue against Locke's theory if we find the current laws to be acceptable. The purpose of this paper is to simply describe the relationship between Locke's theory, intellectual property, and the current law with the conclusion that Locke's theory and the law are incompatible.

I will begin by explaining Locke's labor-based theory and the current intellectual property laws surrounding copyright, patents, trade secrets, and trademarks. Afterwards, I will investigate possible viewpoints regarding the intellectual commons and then apply Locke's theory to intellectual property. Furthermore, I will argue that intellectual property can easily pass the "Enough and as Good" provision, due to its non-rivalrous nature, and the "Waste" provision, due to the constant existence of future possible uses. Afterwards, I will explain how the current laws do not stack up against his theory due to expiration terms, over-exclusivity, and derivative

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[1] Locke's original had "property" instead of "pursuit of happiness."

ownership. Finally, I will conclude with some remarks about possible modifications to the law and indicate how Utilitarian justifications might be incompatible for the current law as well. The motivations for this project are primarily intellectual. The success of this project means that Locke's theory of property gains a little bit more of a defined shape. This may not be compelling to some people, so they may think of the success of this project in terms of removing one of the pillars of support for the current property law. John Locke has been cited in court cases before,[2] but as I will attempt to show here, doing so in support of the current property laws runs afoul of his own theory. Now, it is time to actually look at his theory.

II. Locke's Theory of Property

In Locke's Second Treatise, private property initially begins as public property in the commons. The commons is everything that God has gifted to humans in order for them to make use of it for support and comfort (§26). People in the commons only owned two things: themselves and their labor (§27). Everything else was open for everyone to use. When a person mixes her labor with an object in the commons, however, that mixing of owned and unowned means that what was previously in the commons is now out of the commons and is only owned by a single person (§30). In other words, the combination of private labor and a common object results in a private object. To give an example, while the ocean and everything contained within is in the commons, the fish that a fisherman catches belongs to him and no one else. The private labor of the fisherman means that the once-public fish is now a private fish. This right to property is strong, but is not limitless.

The first limitation is the Enough and as Good provision which states that laborers have to leave as enough property in the commons and it has to be just as good because when this is followed, it effectively means that nothing is removed at all (§33). To illustrate, Locke gives the example of a person upstream taking a drink from a river leaving enough and as good water left for people to take a drink downstream. Because the person upstream followed this provision, people downstream are not injured.

The second limitation is the Waste provision which states that laborers lose their rights to property if that property is going to be wasted (§30). God gave the commons to be used, and when a laborer wastes part of it, punishment is deserved because she invaded other people's right to it (§37). Locke writes that a person who wastes "invade[s] his neighbour's share, for he ha[s] no right, farther than his use called for…" (§37, emphasis in original). Locke gives the example of a laborer losing her rights to food that she acquired because she was going to let the food expire. In that case, her rights to the food are forfeit so that anyone else may have the right to use in order to prevent wastage. In light of this explanation of Locke's theory of property, let's turn toward the current intellectual property law in the United States.

III. Current Intellectual Property Law

When it comes to the current state of intellectual property law in the United States, it is important to note that there is not just one system but there are actually several different types: copyrights, patents, trademarks, and trade secrets. Copyright covers written works and other artistic projects such as art and photography (U.S. Copyright. Chapter 1. Sect. 102). Patents cover inventions (U.S. Patent and Trademark Office, General Information. 2015). Trademarks cover things like logos that are used in identifying a specific brand (USPTO, Trademark. 2016). Trade secrets are intellectual property that are important for a company to use and their effectiveness is at least partially tied to their secrecy (USPTO, Trade Secret. 2019). For the purposes of this paper, only a few key attributes are important. The first is that for patents and copyright, there is a set lifetime of rights until they expire. For patents, it is generally 20 years while for copyright it is the life of the author plus 70 years. Those two types also impact derivative work. Copyright holders hold the rights to all derivative work while patent holders have the rights to any similar derived work. For trademarks and trade secrets, rights are in principle indefinite, but require protections enforced in order for them to exist. For instance, trademark holders or trade secret holders have to sue for trademark infringement or if someone reveals the trade secret in order for the protections to remain. Another key aspect is that it is possible for two independent creators of the same object to have a copyright or trade secret, but it is not possible for patents or trademarks. Even if a second person independently comes up with the idea, she is unable to receive a patent or a trademark if one is already filed by a different person. To illustrate the differences between the different types of intellectual property law, take the case of WD-40. WD-40 is a common aerosolized water displacer and rust remover that was invented in 1953 (Martin. 2009). The company could have patented the product as it was an invention, however, doing so would have meant explicitly revealing what the formula is and how it was produced. With this information, competitors could remake it and sell it as their own after the patent expired. Instead, WD-40 is protected as a trade secret, which means that there are protections against revealing the formula as long as it remains a secret. This does mean, however, that any company could reverse-engineer the product and sell it as their own and the WD-40 Company would have no recourse. Even if a competitor can reproduce the product, they still cannot sell it as "WD-40" because the name itself is protected as a trade mark. Now, let's move towards Locke's theory and intellectual property.[3]

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[2] Locke's reasoning has been cited in many court cases including Bank One Chicago, N. A. v. Midwest Bank & Trust CO and Industrial Union Department, AFL-CIO v. American Petroleum Institute et al in which Locke's argument about entrusting the power to legislate rather than the power to choose legislatures is used and Department of Transportation, et al., Petitioners v. Association of American Railroads in which Locke's limit on the government due to personal liberty is used.

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[3] There might be some concern about Locke's theory that I'm going to address here. The first is about the coherency of 'mixing' one's labor. Robert Nozick famously asked in his *Anarchy, State, and Utopia*: "If I own a can of tomato juice and spill it in the sea so that its molecules (made radioactive, so I can check this) mingle evenly throughout the sea, do I thereby come to own the sea, or have I foolishly dissipated my tomato juice?" (174-175). Another is that there is no such thing as intellectual labor and thus, Locke's labor-based theory cannot provide any justification for intellectual property. In any case, any underlying problems of Locke's theory as a whole does not undermine this project as it's only looking at the relation between the theory and intellectual property.

In order for intellectual property to come out of the commons, it has to be in there first. Locke says that "God...has given the earth to the children of men" and only gives tangible examples (§25). Despite this, I think that Locke would assent to an intellectual commons as well. If the Earth was given to support and comfort humans, then ideas that support and comfort humans would seem to have been given as well. God also gave us the mental capacities to grasp and use intellectual property, so if nothing else, he 'gave' us intellectual property in that way.

Moving away from a religious justification, an intellectual commons still does not seem to be too far-fetched. The physical commons consists of the physical objects that belong to everyone, similarly, the intellectual commons consists of the mental 'objects' that belong to everyone. The exact details of that, however, are not too clear. I am going to explicate a few conceptions of what the intellectual commons could consist in.

The first possible conception of the intellectual commons is based on Locke's views in his Essay Concerning Human Understanding. In Essay, Locke is commonly thought to argue against Realism, which posits the ontological existence of universals.[4] The view that he's arguing against is the view that there exists some sort of intangible object independent from us, known as either a universal or a type, that has tangible instantiations, known as tokens. To put it in a different way, the standard view has the distinction "between a general sort of thing and its particular concrete instances" (Wetzel. 2018). For example, a Realist would make the distinction between a story in itself and the story as it is printed in a book. The story itself would be the universal or type while physical copies would be the instantiations or tokens of the story. Instead of this, Locke believes in Nominalism, which is the theory that what explains the generality of our linguistic terms and knowledge are "abstract ideas," which are abstracted from particulars based on their observed similarities, rather than universals (Book 2, Chapter XI, Section 9). To illustrate the difference, take Locke's example of whiteness and how it applies to milk, chalk, and snow. Under Realism, each of those three items 'partake'[5] in the type or universal of Whiteness. Under Nominalism, however, our idea of Whiteness comes from sensory observations of the three items when we abstract the similarities of their color. To put it in other words, the concept of Whiteness wouldn't exist if we didn't abstract it from our perceptions. Taking a look at the intellectual commons with Nominalism in mind means that the commons isn't filled with universals. This obviously follows since universals do not exist under Nominalism. Would supporters of a Nominalist intellectual commons be doomed to having it be empty? I do not believe so. If we wanted to extend the intellectual commons to still exist under Nominalism, then we could say that it's filled with abstracted objects. Now, there might be an immediate objection because abstract ideas exist only within our minds and not in anything outside, which is the definition of abstract ideas after all. While this is true, it is also true that there is a real purpose for abstract ideas. Abstract ideas function so that we may have general

terms for items rather than only having proper nouns.[6] An intellectual commons under this conception would be filled with those individual abstract ideas that resemble others' abstract ideas. It would be a sort of shared knowledge between people. The problem is that this type of pseudo-commons would seem to be fundamentally different from Locke's conception of the commons in the Second Treatise. Even if we accept the idea of the pseudo-intellectual commons, there would have to be several in order to account for different societal abstract ideas. For example, there might be differences in the conception of color between different societies that would require different commons. This goes against Locke's conception which seems limited to only one common.

The second possible conception of the commons is a Realist one. A Realist could conceive the intellectual commons as consisting of all types or universals. One of the effects of this is that under this viewpoint, the conception of intellectual labor would have to be different from Locke's conception of labor. Under Realism, the idea of labor being an original act of creation cannot occur because all ideas already exist, they just haven't been instantiated yet. Instead, labor would have to be defined more along the lines of being the first to instantiate the pre-existing idea. I believe that Locke's property theory can still account for this because it is still a laborious act to be the first to instantiate[789]

With these two different conceptions, where does that leave the commons? Either conception has some problems, but there might actually be something going for the idea as a whole. As Justin Hughes recognizes: "[i]t requires some leap of faith to say that ideas come from a 'common' in the Lockean sense of the word. Yet it does not take an unrehabilitated Platonist to think that the 'field of ideas' bears a great similarity to a common" (p.314. 1988). Furthermore, Hughes argues that the intellectual commons is actually more aligned with Locke's conception of the commons than the standard physical one. The reason behind this is that it perfectly fits the Enough and as Good Provision while the traditional commons does not. Intellectual property perfectly fulfilling the Enough and as Good provision will be shown in the next section.

V. Intellectual Property and the Enough and as Good Provision

Intellectual property does not seem to violate Locke's Enough and as Good provision. The reason why is due to the fact that intellectual property is non-rivalrous—someone else's possession of an idea does not prohibit my own possession of the same idea. To illustrate the difference between something being rivalrous versus something being non-rivalrous, take the example of fishing. When a fisherman catches a fish, a different fisherman

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[4] For the purposes of this paper, I will assume this. To see an alternative view that defends a Lockean notion of universals, see "Locke's Theory of Universals" by R. I. Aaron.

[5] The exact nature of the relationship between types and tokens differs based on the theory. Platonic Realism posits the type as being completely separate from space and time while Aristotelian Realism posits that types exist solely within their tokens. I use 'partake' as a theory-neutral term, even if it is more vague than what is comfortable. A further in-depth distinction between different Realist relations is not relevant for this paper.

[6] From a lecture with Dr. Gasdaglis.

[7] I specifically mention being first, however, as I will bring up later in the paper, being first might not be a necessary component. What grants property rights for Locke is labor itself, not originality. This would mean that intellectual labor could instead be the instantiation of an idea, without consideration as to whether it's the first or not.

[8] There might be a question about how it is that a person can access an intellectual commons if it's filled with universals. That is an interesting question and figuring out how interactions work with universals is a question that has plagued philosophy for a while and is outside the scope of this paper. I am assuming that some sort of interaction is possible.

[9] There might also be a question of what intellectual labor is. If an account of intellectual labor is needed, then I will assume the basic position that it's some sort of mental effort that leads to knowledge of an idea. This is a vague account, but will be sufficient for the purposes of this paper.

next to him cannot catch the same fish (assuming that it was not released back into the water.) That makes fishing a rivalrous activity. On the other hand, two people can simultaneously use the same technique for making pasta without causing any problems for the other person. This is because the technique itself is non-rivalrous. Now, there is a question about whether some intellectual property is rivalrous. The reason behind this is that competitive strategies, such as stock trading schemes, lose their effectiveness when known by too many people. This is taken to mean that competitive strategies are rivalrous and that there might be special consideration for them. The problem with this objection is that the value of the idea is not intrinsically tied into the idea itself. Take the following example for instance: imagine that there are two different trading schemes, Good Scheme—which works well if it is used and no one else knows about it—and Bad Scheme, which works just as poorly as a well-known Good Scheme. In the case that Good Scheme is known only by one person, both Good Scheme and Bad Scheme are pieces of intellectual property, however, one obviously works better than the other. In the case that Good Scheme is widely known, its value as a competitive strategy decreases to that of Bad Scheme, but they are still two pieces of intellectual property. While it is true that the effectiveness between an exclusive Good Scheme and a well-known Good Scheme are different, the Bad Scheme is still non-rivalrous even though it's ineffective and so it is unclear how the Good Scheme becoming as effective as the Bad Scheme makes it rivalrous. Both the Bad Scheme and the well-known Good Scheme can be ineffectively used by different people at the same time. This objection ultimately conflates the rivalrousness of the effectiveness with the non-rivalrousness of the intellectual property. Getting back to the provision, intellectual property's non-rivalrousness nature means that it can do nothing but satisfy this provision because it's still technically available for others to come up with and use.

VI. Intellectual Property and Waste

In order to understand how the waste provision interacts with intellectual property, it is crucial to understand exactly what Locke meant in his Waste provision. Locke's definition of waste is not exactly clear, but the definition that I would like to propose is that waste occurs when an object can no longer be useful. I believe that this tracks what Locke meant. Locke writes that people are limited to "as much as any one can make use of to any advantage of life before it spoils" (§31, emphasis mine). This proposal is similar to Hughes's definition that waste occurs when an object no longer has "...the present potential use…[nor] the future potential use of its owner" (pp.327, emphasis in original). Given that intellectual property can always have a potential future use, this means that it can never be wasted. In other words, there will always be a context in which intellectual property can be used. The reason why intellectual property can always be useful is that even for those that are not currently in use, they can at least always be used as a teaching tool for example.

Some might object to this analysis, however. Edwin Hettinger and Benjamin Damstedt both advocate that a significant amount of intellectual property is actually being wasted. The argument from both can be combined and distilled into the following basic form:

1. Intellectual property's nature means that there are countless numbers of copies or potential copies, due to the almost zero marginal cost of making one.

2. Intellectual property is often available only to select members of society where access is usually achieved by requiring payment. Some of these people are putting some of the intellectual property to use.

3. There exists a different subsection of society that would like to gain access to the intellectual property, but is unable to for whatever reason.

4. Therefore, while some copies are being used, there are plenty of copies which are not going to use and thus, the intellectual property is wasted.
The problem with this argument is that depending on the definition of waste, the conclusion doesn't follow from the premises. Damstedt gives the definition that "waste occurs where a unit of a product of labor is not put to any use" (p.1182. 2003).[10] The problem with this definition is that it can be taken two ways. The first way is a strict interpretation that a unit of labor has to be immediately put to use otherwise it's wasted. On this interpretation, the conclusion follows from the premises, though it is inconsistent with Locke's text. Locke writes that "...if the fruits rotted, or the venison putrified [sic], before he could spend it [then he wasted them]..." (§37). This would seem to suggest that there's a time where the product of labor, in this case fruit or venison, exists and is being unused, but is not wasted yet. The second interpretation is that waste occurs when a product of labor can no longer be put to any use. This is looser in that it accounts for Locke's wording, but it is unclear how it would be different from my definition proposed earlier. The conclusion would also not follow from the premises because just because there are some units not being used by certain individuals now, doesn't mean that they are being wasted; i.e. they may hold value for the future for certain other individuals or contexts. Thus, because this second, wider definition is closer to Locke's discussion of waste, I don't think that under Locke's theory, intellectual property can be wasted.[11]

The importance of this fact is that waste seems to be the only way in Locke's theory for someone to lose their property rights once they gain them. Locke gives the example of gold and how it would "...keep without wasting or decay[ing]..." (§37). Because of this, people are allowed to accumulate vast amounts of wealth precisely because we attach value to something that cannot be wasted. This also means that our intellectual property rights do not expire and so we are able to accumulate as many rights we want. What exactly are those rights that don't expire? Hopefully the next section will help to elucidate what is meant by rights.

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[10] Hettinger doesn't provide any specific definition of waste, but still holds a similar view to Damstedt.

[11] One possible avenue for intellectual property being wasted is if all of the knowers of the intellectual property forget about it. Exploring as to whether or not this is the case is outside the realm of this paper; however, even if it is the case, then all it would seem to entail would be some kind of duty to archive ideas rather than a limitation on rights.

VII. What Rights Exactly?

So far, I have not explained what I mean by "intellectual property rights." What's cause for concern is that property rights seem to include several distinct rights.[12] One of these, of particular note, is the right to exclude. When it comes to tangible objects in the commons, it is quite certain that there is no right to exclude (§26).The commons is supposed to be open for all to use. It is also quite certain that a right to exclude exists once those objects are made private property through the mixing of labor (§27). Once a person has caught a fish, the catcher has the right to exclude others. Trying to apply this logic to intellectual property is problematic because it is non-rivalrous as mentioned above (section V). The fact that it's non-rivalrous means that the right to exclude might not even apply and only the right to personal use, which is a right for one to use something for themselves, could be granted without any negative problems for the rightsholder. In other words, while the right to exclude benefits the owner because property is rivalrous and can experience physical decay, the fact that intellectual property is not rivalrous and is not tangible means that there appears to be no purpose to the right to exclude. To help illustrate, imagine a person owning a pair of high quality scissors. The owner obviously has the right to use the scissors, as long as it's not immoral, and the owner has the right to prevent others from using the scissors, maybe the owner doesn't want the blades to dull out. The owner has both of these rights and for good reason. Contrast this with someone who develops a new process to make pottery. The potter has the right to use the process, as long as it's not immoral, but it is not clear whether the potter can exclude others from using the process. One might think that the potter could have the right to exclude because someone else's use of the process might flood the market, leading to a decrease in profit—if the potter is doing pottery for financial reasons. This, however, seems to be a case of a right to full market value—whatever that could possibly mean—rather than a right to exclude, and the right to full market value seems implausible, if not unintelligible, on its face. Even if there doesn't appear to be a reason to have a right to exclude intellectual property doesn't necessarily mean that it still doesn't exist. So where does that leave intellectual property rights for Locke? We cannot say for certain either way unfortunately.

VIII. An Analysis of the Current Law

With all of this discussion in mind, it is finally time to see how the current law stands against Locke's theory. As a reminder, the aspects of the law that are relevant to this paper are the exclusions of derivative and independent labor and the expiration terms. When it comes to the ability to exclude others even if they independently come up with the same idea, as is the case for patents, that is clearly against Locke's theory. If someone labors, then they have the right to that product. When it comes to the expiration date, that also seems to not be supported by Locke. As discussed earlier, intellectual property cannot be wasted, thus, there isn't any justification for rights to be lost. The active defense for trade secrets and trademarks also cannot find any justification in Locke's theory. If a company owns a trade secret or owns a trademark, then they shouldn't be required to keep it secret or pursue infringement litigation in order to keep their protections.13

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[12] Whether this is conceived as a "bundle" or other type of representation is not relevant for the purposes of this paper.

[13] This doesn't remove any prudential considerations regarding suing for infringement or taking steps to keep secrets secret.

Now, there is a radical idea that the entirety of intellectual property law should be removed because the laws are based on a right to exclude others, which isn't supported by the idea of the non-rivalrous nature of intellectual property. As mentioned earlier (section VII), it is unclear whether Locke himself believes that a right to exclude intellectual property exists. As such, a supporter of the laws would probably say that he does think the right exists and justifies the basis of the law. Detractors, on the other hand, would take the opposite stance that he doesn't think that the exclusionary right exists and thus, the entire basis of the intellectual law isn't justified. I'm not going to comment on which one I think is more accurate to Locke's beliefs, however, even ignoring this doesn't mean that the law is justified. As I argued in the previous paragraph, Locke's theory still doesn't justify the current laws even if there's a right to exclude. While the previous aspects of the law were pretty straight-forward, derivative work seems more complicated.

As mentioned previously, copyright holders have the rights to all derivative work and patent holders have the right to all similar derived work. For example, only the original author of a story can write its sequels and spin-offs and an inventor cannot include a patented invention in her work without permission from the patent holder. In Locke's theory of property, labor is king of the commons, but the extent of its reign is unclear. If one takes the viewpoint that exclusionary rights to intellectual property do not exist, then property right law is completely unjustified, as mentioned earlier. If, on the other hand, exclusionary rights do exist, then that leaves us weighing whether the desert granted by labor outweighs the right to exclude. It's really unclear which one Locke would support for intellectual property. It might be easiest to illustrate the conflict with an example. Many popular media, such as Star Trek, Harry Potter, and the Lord of the Rings, spawn fan-fiction, or works created by fans that use established settings, characters, and other elements from the original work. Under the current system, they are solidly considered as infringements on copyright. The original author put in the labor to create the characters and the setting etc. and so by using the characters without permission from the author, you're infringing on others' labor. Does the original author have the right to prevent extra labor from happening? Does the original author have the right to the fruits of the unauthorized derivative labor? It gets complicated even further when the people who create fan-fiction put in as much, if not more, labor than the original author. Locke doesn't have enough to say on the matter, and so we're stuck. If I had to follow the spirit behind Locke's writing rather than his words themselves, I would lean toward the derivative labor deserving its own rights. This is obviously significantly influenced due to my own biases, however.

IX. Conclusion and Further Thoughts

How could these laws change to become more in-tune with Locke? Well, assuming that the right to exclude exists and so intellectual property laws are in principle justified, the overly-exclusive feature of patents should be removed, the expiration date from patents and copyrights removed, and the requirement for defending trade secrets and trademarks should also be removed. It's unclear whether the derivative features of copyright and patents should be removed, but it's something to critically look into. To recap, Lockean intellectual property law would last forever without needing anything after the initial labor and it would not prevent independent original laboring but may or may not prevent derived labor. Die-hard supporters of the current intellectual property law might be turned away from Locke's

theory because of this, however, they may not find the respite they want in other theories.

I think one of the most obvious theories to turn to would be Utilitarianism. The argument, as is commonly stated, is that the property rights exist to maximize utility because too extensive property rights would stifle creativity and productivity while too weak property rights wouldn't provide enough motivation to labor. If we agree with this line of reasoning, then what intellectual property rights should be is simply an empirical question, but the answers are probably still a departure from the current system. To briefly give one aspect of the conflict between Utilitarianism and the current intellectual property law is with the length of copyright. Rufus Pollock, a researcher from the University of Cambridge, conducted a study that found that the point estimate for the optimal length of copyright is 15 years long while being 99% confident that the optimal term is less than 38 years long (p.56. 2009). This is so much shorter than the current system that it is obvious that it needs to be significantly reduced. This is just one aspect of intellectual property law, so the Utilitarian would need to conduct further research into every aspect of intellectual property. As it remains, the current system is definitely not fully justified by Locke nor is it probably fully justified through Utilitarianism. There might be other theories, but those are even more outside the scope of this paper.

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Impact of COVID-19 on Consumer Behavior and Attitude of University Students Pre- and Post-Food Safety Training.

Abstract

This study is based on an online survey taken by California State Polytechnic University, Pomona students during the COVID-19 pandemic. The online survey assesses the students' attitudes about their pre- and post-food safety training. To see if students are more likely to use commercial foodservice safety preparations. To summarize, the paper investigates the attitudes and behavior of Cal Poly Pomona students regarding their foodservice safety training and as a consumer during a deadly pandemic. The results highlighted an increased awareness on the impact of COVID-19 on food safety post-training.

Introduction

When the pandemic began, not much was known about the Coronavirus (COVID-19 virus). There was limited information regarding the virus' life expectancy on surfaces, especially on the surface of food and food packages (Olaimat et al., 2020). In addition, since many cases of food borne illnesses are related to the mishandling of food, the uncertain survivability of COVID-19 on food surfaces and food packages raises concerns of the virus spreading via food or packages containing food (Knight et al., 2009). The transmission of the virus guides the question concerning the pandemic's impact on consumer behavior and attitude. As a pilot study using university students' responses, the purpose of the current study is to research consumer behavior and attitude pre- and post-food safety training during a pandemic.

Background

COVID-19 and its Impact

The COVID-19 pandemic has disrupted many lives around the world and changed the way people purchase and consume food. Under these difficult times many restaurants have closed or resorted to take out only. Especially with this disruptive outbreak, commercial food services and supply chains must take extra precaution against the virus. As a direct result of panic buying, food and supply chains snowballed into shortages (Ben Hassen et al., 2020). Stockpiling presented issues of accessing healthy food, as consumers were more prone to purchasing nonperishable items such as canned or frozen foods (Ben Hassen et al., 2020). Additionally, consumers diminish the need for perishable items consequentially leading to an excess of food waste. The lack of food variety and increased consumption of processed foods increases the risk of malnutrition and weight gains. Social distancing can induce emotional eating that also contribute to a decrease in the quality of one's diet. Huge contributors to a poor diet during quarantine is the ordering fast foods or comfort foods to ease one's stress or anxiety. With a virus this impactful to our overall health, food safety practices are a critical precursor to safe food and an essential to healthy eating. Accordingly, restaurants must uphold and maintain safe food practices, following requirements provided by the CDC and FDA, for consumers ordering online, particularly during a pandemic.

Consumer Behavior

Foodborne illnesses are harmful and inconvenient to businesses and consumers. A study found a significant number of restaurants that have poor food safety practices largely contribute to foodborne illness (Knight et al., 2009). While the study did not occur during the pandemic, it provides significant background for investigating the importance of food safety practices. Specifically, during the pandemic, there were 7,496 publications relating to "COVID-19" (Laguna et al., 2020). Of those publications, at the beginning of April 2020, 4,382 publications utilized the term "food" (Laguna et al., 2020). About 58% of the publications were food related signifying that food is a pertinent aspect during the pandemic. Whether the search was about restaurants going out of business, commercial food services, preventing the spread through safe food practices, or about functional foods as a prevention against the virus; the pandemic has shown a huge impact on consumer behavior. Prior to COVID-19, studies on consumer behavior and food safety perceptions at restaurants suggested consumers are less likely to return to a restaurant with prior food safety concerns (Baker & Crosbie, 1994; Röhr et al., 2005). The studies also found that consumers are willing to pay for more if the consumable is perceived as safer (Baker & Crosbie, 1994; Röhr et al., 2005). Rimal et al. (2001) claimed that the gap between consumers' level of concern for food safety and food consumption is related to consumers' knowledge of food safety and trust in food services. A study conducted in Brazil noted that food handlers who practice proper food safety procedures in a well-structured workplace have higher job satisfaction (de Andrade et al., 2020). Consumers with adequate food safety knowledge and food handlers in a healthy work environment can contribute to reducing the level of concern for food safety and food consumption.

Consumer Behavior in Relation to COVID-19

According to Olaimat et al. (2020), transmission of COVID-19 does not occur through consuming foods. However, the virus stays on strawberries and lettuce at 4°C up to ten days in which raises a window of transmission concerning the virus via surfaces (Olaimat et al., 2020). As of October 2020, research has found that the virus can remain infectious on a surface between four hours to seven days, depending on: viral load, environmental factors, and type of surface (Hasan et al., 2020). According to the CDC, "COVID-19 has not been shown to survive on surfaces longer than" seven days or more (U S Department of Labor Occupational Safety and Health Administration, 2021). Hence, sanitation practices and following safe food practices are extremely crucial. Precautionary measures include proper hand washing with soap and warm water, usage of hand sanitizers, appropriate personal protective equipment, and maintaining a 6 feet working distance (Olaimat et al., 2020).

Due to social distancing and foodservice restrictions, many consumers have turned towards online food deliveries, resulting in an increased spending of online food delivery services by 70% (Cai & Leung, 2020). It was also noted that participants in the Cai & Leung (2020) study would order online food delivery services more often if there were promotions for using the service. While consumers spend more on food deliveries, consumers in America spend more time preparing and cooking at home as well (Ben Hassen et al., 2020). Cooking at home may be healthier than eating out or take out, but many home kitchens are very different compared to commercial food service kitchens. Many home kitchens serve

as a multipurpose area for all sorts of non-produce and produce washing, cooked and uncooked produce, and non-produce and produce storage places while commercial food service kitchens are strictly used for preparing foods and separately storing cooked and uncooked foods (Byrd-Bredbenner et al., 2013).

Research Question

This research focuses on how the pandemic has impacted the consumer behavior and attitude of university students who are learning about food safety. Recently, a lot of research has been conducted on COVID-19 in hopes of preventing the spread and finding solutions to the virus. The topic of "food" was widely researched in relation to the virus and food safety. Practicing proper food safety procedures limit the spread of diseases, considering consumers are more likely to intervene when witnessing food safety violations (Harris et al., 2020). Although during the pandemic, consumers are not able to witness food safety violations in person, restaurants resorting to online food delivery must uphold their level of food safety practices. In a noncommercial setting, such as cooking at home, practicing proper food safety habits will help decrease food borne illnesses. Overall, food safety provides consumers with the precautions pivotal to better and safer food, especially in a pandemic.

Methodology

This online survey, using Qualtrics, was administered to four different nutrition and food science courses at Cal Poly Pomona. These classes were chosen because they include food safety as part of or all the courses. The questions were adapted from Knight et al. (2009)'s study on "Dining for Safety: Consumer Perceptions of Food Safety and Eating Out". After IRB approval (IRB-20-222), student participants were recruited through email in a three week window during the Spring 2021 Semester. Of the 236 possible participants across the four classes, 16% (38) of the students responded.

The survey contain questions related to the university students' consumer behavior and their attitudes pre- and post-food safety training, with special attention to the impact of COVID-19 on these decisions. The survey consists of multiple choice and sliding scale formats that are structured into three sections: sociodemographic (five questions): gender, student status, living distance from school, age, and ethnicity; pre-food safety training (five questions): spending per week on food service, concern of contracting COVID-19, concern of foodborne illness exposure, restaurant safety performance, and thoughts about food safety; and post-food safety training (five questions): the same as pre-food safety training. Of the 38 participants, 80.6% were female, 50% were junior status, 55.6% live more than 20 miles away from the Pomona area but within California, 28.6% were between the ages of 21 and 23, and 36.8% were Latinx (Table 1).

Upon completion of data, sociodemographic and pre- and post-food safety training responses were analyzed with SPSS 25.0. Paired sample t-tests were used to compare the pre- and post- consumer questions.

Table 1. Sociodemographic characteristics (n=38)

		Frequency	Precent
Gender	Male	6	16.7
	Female	29	80.6
	Other	1	2.8
Student status	Undergraduate - Freshman (0-30 credits)	3	8.3
	Undergraduate - Sophomore (31-60 credits)	2	5.6
	Undergraduate - Junior (61-90 credits)	18	50
	Undergraduate - Senior (>90 credits)	13	36.1
Living distance from school	Off campus, in or around the greater Pomona area	13	36.1
	More than 20 miles away from the Pomona area, but within California	20	55.6
	Outside of California	3	8.3
Age	18-20	6	17.2
	21-23	10	28.6
	24-26	7	20
	27-29	5	14.3
	30+	7	20.2
Ethnicity	Latinx	14	36.8
	White	6	15.8
	Asian/PI	3	7.9
	Other	8	21.1
	Did not reply	7	18.4

Results

The results regarding post-food safety training compared to pre-food safety training suggest an increased awareness of food safety. Table 2 highlights the differences of pre- and post-food safety training. Post-training, participants thought about food safety more often (several times a week) compared to before training (once in a while). The participants also spent more per week on commercial food services prior to training (mean = 1.88). Post-training, participants spent less per week on commercial food services (mean = 1.74). These means correspond with the participants' thoughts on restaurant safety performances. Pre-training, participants thought restaurants did a good job of making the food you eat safe. However post-training, participants thought restaurants did neither a good nor poor job of making the food consumers eat safe. Additionally, the level of concern regarding foodborne illness exposure (mean = 3.84 to mean = 6.06) and contracting COVID-19 increased post-training (mean = 5 to mean = 5.58).

Table 2. Paired-Sample *t*-test results

	Pre-Training		Post-Training				
	M	SD	M	SD	*t*	*df*	*p*
Spending per week	1.88	0.91	1.74	0.96	1.41	33	0.169
(1 = $0-$20, 2 = $20-$40, 3= $40-$60, 4 = $60+)							
Levels of concern exposure to foodborne illness	3.84	2.54	6.06	2.77	-4.92	31	0.001
Concern of contracting COVID-19	5	3.15	5.58	3.12	-1.17	32	0.249
(1 = little, 10 = lots, sliding scale)							
Restaurant performance	2.09	0.79	2.5	1.02	-2.8	33	0.008
(1 = very good, 5 = very poor)							
Think about food safety	3.29	0.87	4.15	0.7	-5.37	33	0.001
(1 = never, 5 = everyday)							

Discussion and Implications

Spending Per Week

Spending per week decreased after training (mean = 1.74) and the data provided no significant change. Spending per week was expected to decrease because during quarantine less people went out to eat, therefore decreased their spending (Ben Hassen et al., 2020). Although take out or food delivery are alternatives, many consumers started cooking at home (Ben Hassen et al., 2020). Spending per week's data could have been improved by adjusting the scale to five dollar increments rather than ten dollar increments.

Levels of Concern Exposure of Foodborne Illness

There was a significant increase in concern about exposure to foodborne illness from before and after food safety training. Prior to training, participants reported less concern about the exposure to foodborne illnesses (mean = 3.84). However, after training the participants' concern about exposure to foodborne illness almost doubled (mean = 6.06). As seen in Rimal et al. (2001), the results implicate an association between consumers' knowledge of food safety and the consumers' level of concern about the exposure of foodborne illness. In addition to consumers' knowledge, the consumers' trust in food services influences the consumers' level of concern. With high trust in food services, consumers are more likely to return and potentially increase spending.

Awareness heightened regarding the transmission of the virus because this study was conducted during the pandemic. As consumers' awareness increased, participants' concern about exposure to foodborne illness simultaneously increased. Due to the severity of the quarantine, participants could have associated the increased concern of the virus to food.

Restaurant Performance

Participants had a statistically significant different rating of restaurants' safety preparations before and after training. Prior to training participants thought restaurants did a good job of preparing food safe and well (mean = 2.09), while after training participants approximately thought restaurants did neither good nor poor (mean = 2.5). According to de Andrade et al. (2020), food handlers in Brazil who work in a well-structured environment have a higher job satisfaction and practice proper food safety procedures. Though it is difficult for consumers to gauge a worker's job satisfaction, especially in the pandemic, the data after training suggests participants thought restaurants' safety preparations were neither good nor poor. To increase consumers' trust in restaurants' safety preparations, restaurants could present more visible cleaning practices. In addition, both the consumers and food services should be aware of the safety requirements provided by the CDC and FDA to ensure safe standards for everyone.

Thinking About Food Safety

Prior to training, participants thought about food safety "once in a while" (mean = 3.29) Compared to after training, participants thought about food safety "several times a week" (mean = 4.15), which was a statistically significant difference. It is understandable that the students would be thinking about food safety more often as they are enrolled in courses that teach food safety. There is also the possibility that the respondents are thinking more often about food safety due to the pandemic, as not much was known about the virus. Especially as of October 2020, researchers have found that COVID-19 can stay on surfaces up to seven days (Hasan et al., 2020). Disinfecting surfaces can help reduce transmission and keep people safer.

Limitations and Future Research

As with all research, this study has limitations that must be addressed. The response rate was relatively low (16%). Data may differentiate from participants with no background in

nutrition or food science. Additionally, participants were drawn from the same university with a majority response rate from females. Future research could be expanded to participants from other universities and include more males. Participants may have previously enrolled in courses the Co-PI and PI have taught that may contribute minor bias. However, there is no collection of any identifiable information of the participants. Due to the pandemic every part of this survey was done virtually. Future studies should retest the same participants several months to a year from the present study to assess and changes.

Conclusion

Overall, this research assesses the attitudes and behaviors of students pre- and post-food safety training in relation to their use of commercial foodservice operations, especially considering COVID-19. The findings of the study found a statistically significant increase of awareness towards foodborne illness, restaurant performance, and food safety considerations. With increased awareness, it is important to practice proper food safety habits to stay healthy and safe. Future food service operations can use this study to improve their food safety practices, as well as create a safer environment for their consumers and workers.

Acknowledgements

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