

REACH

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ABSTRACT

In our current world, we encounter new environmental problems every year and emerging technologies can be used to increase awareness. Immersive agricultural education with Virtual Reality can increase knowledge of conservation efforts for rare sheep that produce unique wool as a natural, renewable resource. Virtual Reality programs place a user in a computer simulated, immersive environment for a multitude of uses. The Livestock Conservancy launched the “Shave ‘em to Save ‘em” (SE2SE) initiative to help address this concern. The current project aims to educate the user and aligns with the SE2SE initiative, which increases awareness of rare wool and in turn can raise the population of endangered species. As we continue to develop interactive technologies with user experiences, it is critical to connect it to emerging conservation efforts. Virtual Reality systems allow a user to have a first-person view in a virtually created environment. Artificial Intelligence technology can be used to add immersion with non-player characters (NPCs) that move and interact independently with their environment using computer code. Our research aims to optimize a functional VR “For Ewe” demo app, which uses Unity software with 3D asset computer generated sheep to teach users about different types of rare sheep and their wool. Optimizations of in-game processes include a counter that tracks in-game rare sheep found and adjustments to the number of in-game NPC’s. In the future, the updated demo app will be used with the Oculus Quest 2. We hope our research contributes to a growing study of technological applications in agricultural education.

Index Terms – Artificial Intelligence, virtual reality, visualization, education, agriculture

I. INTRODUCTION

Virtual Reality (VR) systems are relatively new tools that use sensors and three-dimensional displays to immerse the user in a virtual computer simulated world. The user can interact with this environment with a controller. Artificial Intelligence (AI) is a broad term for computer simulated “thinking” where an algorithm or computer code gives software or machinery intelligence. Our VR software utilizes AI to create a more immersive educational experience. The VR “For Ewe” sheep experience places the user in a virtual environment to learn about different kinds of rare sheep and their wool as shown in the Trejo study [1]. AI has proven useful in the agricultural field as recorded in a study by Bhagat et al. [2]. VR is currently utilized in education to teach logic-based subjects. New studies show the benefits and effect on information retention and overall understanding according to research conducted by Holly et al. [3]. It is becoming increasingly important to spread awareness of environmental topics. Our software also mirrors the efforts of the non-profit Livestock Conservancy “Shave ‘em to Save em” initiative, which aims to strengthen populations of endangered sheep by increasing awareness of their wool. This research intends to contribute to the growing studies of VR and AI in agricultural education.

A. VR AND HMD’s

Commercial Head Mounted Displays (HMD) were available in the 1990’s but they were technical nightmares nowhere near as strong as they are today. They featured low resolution graphics and were commercially used in retro gaming consoles. In the 2010’s this technology was greatly improved and made more accessible. The hardware setup time was relatively high and in this state would not be as useful in the classroom or as an educational tool. The HMD was overall inefficient. In the last 10 years, this technology has been greatly optimized in both software and hardware. The original Oculus system also needed to be accompanied with a high functioning computer to run software from, and sensors needed to be drilled into the walls in a dedicated space to detect user movement. The Oculus Quest can act independently from any computer and its experience is not hindered by a nest of wires or sensors, which in turn greatly improves setup time and accessibility. This technology has reemerged into the mainstream according to research by Renganayagalu et al [4]. Especially when you take into consideration its reasonable price, which has increased accessibility for a wide range of applications due to the growing popularity of VR and estimated 171 million VR users worldwide.

B. LIMITATIONS OF VR

HMD’s have seen drastic improvements in recent years. They have become more cost friendly, but they do have their limitations and older models even more so. Older models tend to be more bulky and uncomfortable with a nest of wires protruding from the monitor. A computer was also required to run programs because older HMD models only served as a monitor. Setup times were high for older models that would make them impossible to successfully implement this technology in the classroom. Advances with the Google Cardboard, Samsung Gear VR, and Oculus have improved user experiences with no connection needed to additional monitors with wires. The entirety of the hardware is self-contained in the controllers and the HMD, but even so some people are not accustomed to the sensation of VR and may experience motion sickness. VR is primarily an independent experience, meaning group collaboration in the classroom can be difficult.

C. VR IN EDUCATION AND AGRICULTURE FIELDS

Many studies regarding the applications of Virtual Reality in the classroom revolve around the idea that STEM subjects should be taught in a hands-on style that VR could achieve. Many students struggle in these subjects due to lack of physical conceptualization. Experiments in physics, biology, and chemistry are costly, time consuming, and in some cases pose a danger to students. VR side steps all of these issues and is the perfect solution to this problem. Many schools are beginning to lean towards using technologies in the classroom so it is entirely possible we could begin to implement VR HMD’s for classes that could directly benefit from physical conceptualization. Holly et al. [3] studied the use of Maroon, a VR program in a physics classroom. Maroon offers students a virtual space to conduct physics experiments. A survey taken of students who used this program in the classroom showed that they generally enjoyed the

program and felt that it was beneficial to their classroom experience. While the hardware itself does come with limitations, students stand to gain hands-on experience from this technology. Another classroom study was conducted in the Chen et al. paper [5] to test VR’s effectiveness in the geography classroom and a survey validated the results of the aforementioned study. Being able to physically conceptualize geographical landmarks led to a more educationally enriching experience for students and was even shown to improve test scores with students.

A study by Rack-Woo et al. [6] details the experience of using VR to build pseudo piglet houses to increase yield and improve animal living conditions. Korea is one of the world's leading producers of pork, yet their climate does not support these animals year round. Production companies use temperature controlled facilities to support these animals and VR software was utilized in employee training to design virtual facilities. Along with Artificial Intelligence techniques, designers were able to test airflow in these livestock housing facilities. Airflow is essential in maintaining good living conditions and heightening yield for the product. This study contributed to the research on both VR and AI being used to benefit primarily the agricultural field and was used to train employees in these fields.

Use of AI technology as a tool has been studied by Bhagat et al. [2], which describes the use of AI as a cost cutting measure. After the Covid-19 pandemic, a labor shortage significantly affected the transportation efforts of agriculture companies. There were far less truck drivers and too many routes to handle efficient transportation. AI software was used to optimize supply chains. This cut transportation and labor costs, while allowing companies to cut their carbon emissions. AI was also utilized to help farmers predict soil conditions for crops.

The study uses the initial build of the VR Sheep “For Ewe” experience, which is detailed in the Trejo study [1] for using activity theory to guide the creation and process of the game and lay out possible outcomes from using this software in an educational setting. The program was then observed in various states of development to plan potential optimizations.

As research was conducted for this study, it became increasingly apparent that there was a lack of research available detailing the intersection of VR/AI and agriculture. Many resources exist detailing these topics on their own and can be applied to our study in cohesion with one another. Our research contributes to a growing study of VR and AI’s use in the agricultural sector and as an educational tool.

D. REALISM VS. IMMERSION

Research conducted by Holly et al. [3] brought to light a dialogue on realism versus immersion in VR games. Virtual Reality environments have become increasingly realistic in quality in recent years due to improved technology and creation processes. These environments are meant to mimic real life, but how critical is realism? Plenty of amateur developers may not be able to recreate the highly realistic environments that large independent studios can. Thankfully, immersion is by far more important. While realism leads to a more physically grounded experience, immersion helps users get involved with the environment. When education is the core goal of a program, interaction always comes first. Interaction in VR aids in

information retention and the overall learning experience. When creating educational VR applications, developers need not worry about how realistic their environment looks.

E. VR SHEEP EXPERIENCE

The initial sheep experience places the user in a grassy valley with trees, hills and farm structures. Various sheep non-player characters walk around the environment. A text display appears indicating to locate rare sheep. As the player navigates the virtual environment, they will inevitably run across nonmoving “token” (Figure 1.1) collectible sheep that show facts about the sheep and their wool overhead. When the user collects a total of 22 sheep, they appear in a pen past a finish line and the objective of the game is complete (Figure 1.2). The user can then end the game or continue to freely navigate the environment.



Figure 1.1 “Token Sheep”

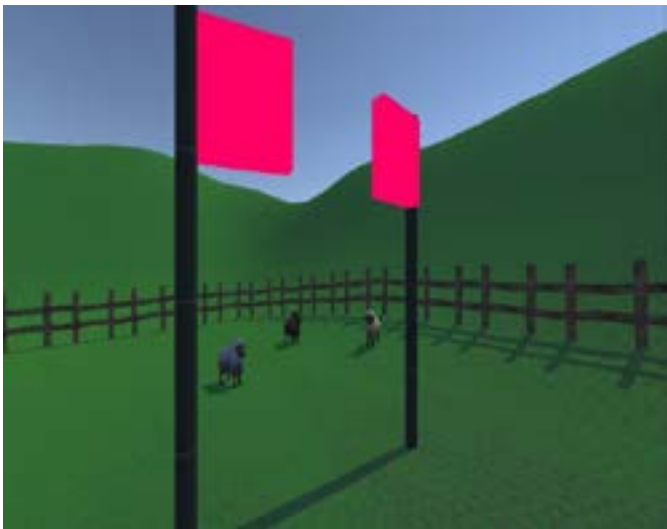


Figure 1.2 “Token” Sheep in Pen

II. METHODOLOGY

The demo app “For Ewe” software was comprehensive from a technical standpoint as it required multiple techniques and included virtual environment design, AI integration, and particularly optimization. The software applied approach builds from previous research conducted by Jay et al. [7], which suggests that software is valuable to increase knowledge as a scholarly contribution. Software itself has the potential to improve analysis and processing of data. In the research community, some academic minds are reluctant to cite their own code due to it being perceived “as poor quality” and reflecting poorly on their work as a whole. Inversely, this openness allows for others to follow the work and perhaps fix any mistakes made while broadening the horizons for like-minded projects.

This study included three primary phases including observation, training, and optimization.

A. Phase 1

During the observational phase, two “For Ewe” demonstration apps were reviewed through an Oculus Quest 2 HMD. The first “For Ewe” demo app contained only “token” sheep in the virtual environment to test the in-game counting system and text overlays. The second “For Ewe AI” demo app included both “token” sheep, as well as the many NPC moving sheep. These demo apps were engineered during 2019 using the Unity Engine, which is a hugely accessible free engine to create games on multiple platforms.

B. Phase 2

For the training phase, Geig’s resource on Unity programming [8] was used to learn the Unity user interface and game creation process, though it was not entirely applicable to the VR programming. Linowes manual [9] was then used to attempt some artificial intelligence implementation processes to enhance user experience. Through the Unity training process, multiple strategies on game creation were learned including level design, terrain creation, scripting, as well as navigating the Unity software’s various tools and techniques. Unity’s framework is comprehensive and provides almost every tool to create a game preloaded into each program created aside from textures, character models, and height maps as a different form of terrain design. Extra customization elements can be downloaded for free on the Unity website or created on external apps and imported into projects.

C. Phase 3

The observation and training phases informed optimization. The initial program detailed in Trejo’s VR study [1], while well-functioning and effective in its educational content, required some optimization. AI flocking was specifically chosen to be implemented into the software as it potentially adds realism to the software’s NPC sheep models. Flocking is an animal behavior itself, and the AI Flocking algorithm mimics this behavior. Flocking is a multifaceted complex system that places agents, or in this case, the sheep NPCs, in a range around a target. As NPCs enter the range of their target, they then follow the target indefinitely. Their programming keeps them from colliding with each other and the herd size from increasing too much using an algorithm. AI cloning was also researched as an option to reduce the file size and improve efficiency in the program. Some additional fixes to the in-game counting mechanism and user experience updates were added, such as lessening the number of NPC’s.

III. RESULTS

A. OBSERVATIONS

Some problems were present in the “For Ewe AI” build of the program. Initially there were a huge number of NPC moving sheep. Due to their huge quantity, approximately 100, it made finding the non-moving token sheep more challenging. While from a game standpoint this would be perfectly fine, adding this challenge in a program meant to teach facts misdirects the user from the educational content. Another observation made was that the AI looked more robotic because of the large number of sheep and some seemed to mirror the movements of each other, which distracts from the immersion of the game. The counting system was flawed in that

the number of token sheep was incorrect at the end of the program. From a software standpoint the number of NPC sheep was implemented by copying the code multiple times to add sheep. When the program was initially created in 2019, the Oculus Quest 1 HMD was used. Due to this HMD’s computing power, the scripting techniques used, and the file size, there was lag in the game. The Oculus Quest 2 newer model did not have the same problem, but could benefit from an optimized cloning process. There was a script for every individual sheep NPC, but it is possible to create one script that controls all the NPC sheep. This would reduce the number of scripts utilized in the program and in turn reduce the final size, increasing overall performance. To improve the movement patterns of the AI is a separate task that could be solved using AI Flocking techniques detailed in Unity’s Unity Learn page [10].

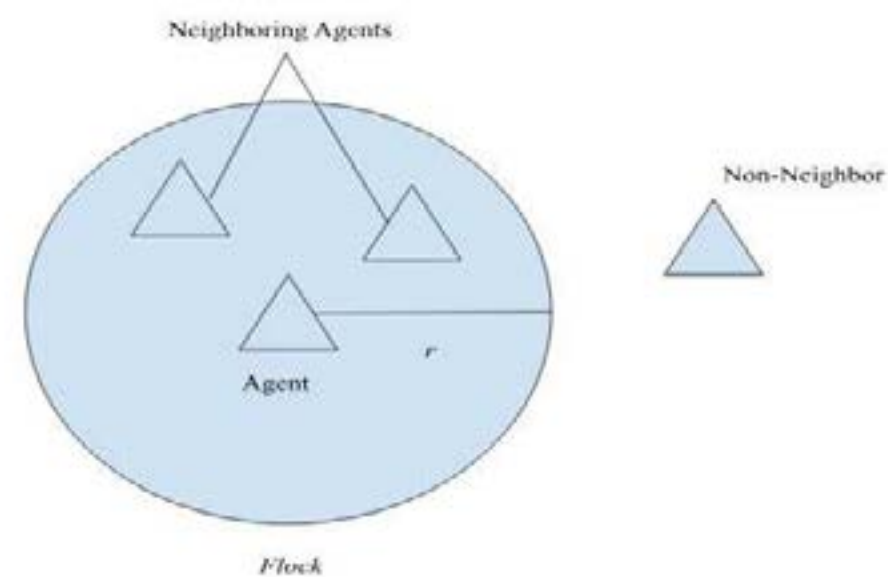


Figure 2.1 Flocking Technique Diagram

B. AI FLOCKING & CODE IMPLEMENTATION

To assist in creating an immersive experience, the implementation of “flocking” AI was the main goal of optimizing the “For Ewe” VR Sheep Experience. The flocking algorithm has three main facets, which include cohesion, alignment, and avoidance (Figure 2.1). Cohesion compels every flock agent to group with other agents in the program. Alignment makes every agent move together and decide the distance to keep from other group members. Finally, avoidance keeps the agents from hitting other groups, their herd size from getting too large, or crashing into obstacles in their path. The algorithm detects the distance between each individual agent within range on a vector. These agents move infinitely, so this distance must be continually determined to keep the agents in line with each other. Objects outside the radius of the flock are considered non-neighbors and based on the number of agents, could be attracted to other non-neighbors to form separate flocks.

AI Flocking Techniques are complex systems that require more technical knowledge. Initially during the beginning stages of code development, numerous compilation errors occurred due to underlying problems with the Unity Client. Two optimization efforts were made.

The first code was written to work within the 3D environment of the Sheep Experience. In the 3D environment, the agents are declared to be on a 3rd vector plane, which allows them to exist and move in the 3D virtual world. This code was unsuccessful due to compilation errors and a lack of advanced technical knowledge.

A second attempt to build the same algorithm on a 2-Dimensional plane instead was made. An issue arose concerning the vector plane used in the 2D program, so the operating portions from the 2D build were then translated into the 3D build. The 3D game build experienced compiler errors, but the code became more filled out and may be expanded upon in the future. This code is detailed in Appendix A Figures 3.2 to 3.4. The initial program included 100 separate sheep scripts accompanied by 100 sheep models. This number was decreased to 50 to maintain a high number of moving components, but make locating “token” sheep slightly easier to locate and improve the overall user experience. This particular version of the game scene is slightly smaller than the original scene file. The counter repair code is detailed in Appendix Figure 3.1 While the code implementation contained bugs, the educational content of the app remains the same. The highlighted coding updates are shown in Appendix A.



Figure 2.2 Sheep Counter Example

IV. DISCUSSION

During efforts to implement AI flocking processes, problems occurred which ultimately led to the code running unsuccessfully. Nonetheless, reducing the number of AI sheep was successful in drawing more attention to the “token” goal sheep and making the experience more immersive. The in-game counter was also successfully repaired. The updated software build is a scholarly output of this research project. Previous studies by Jay et al. [7] have justified this in that the software can positively affect and increase the scale of knowledge production.

The emergence of AI in VR agricultural experiences justifies its attempted optimization in the current “For Ewe” VR Sheep Experience. The quality of immersion is also present in the

program as it is possible to interact with the surrounding environment and interact with the surrounding sheep NPC’s. The reduction of the number of sheep NPC’s can improve content retention towards agricultural education of endangered sheep and their wool.

A. LIMITATIONS

This study had several limitations. One limitation of this study was time. The entire research process and coding updates took place over the course of 8 weeks. Unity itself has a fairly large learning curve and at times importing various game related files, and troubleshooting the daunting interface proved time consuming. This took away from time allotted to develop the many optimizations in the programming. Troubleshooting code is an entire process on its own, and very time consuming. The Unity Engine works in coordination with Microsoft VS Code to script the software. This software experienced problems when working alongside Unity as VS Code was missing some packages to operate with Unity Software. Ultimately, a large amount of technical knowledge is required for every aspect to work cohesively with one another. With an extended time, as well as more accurate knowledge of the AI coding process, it may be possible to improve the experience further.

CONCLUSIONS AND FUTURE WORKS

This research project may be expanded in the future. As previously stated, the main drawback from this project was time, and with more advanced technical knowledge and AI knowledge, it may be possible to further optimize the program. A survey would also benefit this project as then the true educational values of the software can be tested among a sample group of preferably students. Then data could be tracked on content retention and the overall user experience.

This study contributes a valid method for implementation of software and development processes. To enable sustainable agricultural processes, it is important to educate people and use tools to reach a wide audience. Using VR, an emerging technology with a multitude of applications is critical. Computer software is constantly evolving and in the near future, there may be new or improved ways to implement the AI as attempted in this study. This research provides valuable insight into the development processes of immersive educational tools and stands to contribute to the growing applications of these tools in the agricultural and educational fields.

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[10] “Flocking,” Unity Learn, <https://learn.unity.com/tutorial/flocking>

APPENDIX A

Supplementary images of code repairing in-game counter as well as code tests for unsuccessful Flocking AI.

```
387 if (other.gameObject.CompareTag("sheepZone20"))
388 {
389     Debug.Log("I left the Florida Cracker sheep");
390     sheepText.text = "";
391 }
392 if (other.gameObject.CompareTag("sheepZone21"))
393 {
394     Debug.Log("I left the Cotswold sheep");
395     sheepText.text = "";
396 }
397 if (other.gameObject.CompareTag("sheepZone22"))
398 {
399     Debug.Log("I left the Jacob sheep");
400     sheepText.text = "";
401 }
402 }
403
404 void SetCountText()
405 {
406     countText.text = "Your Sheep: " + count.ToString();
407     if (count == 22)
408     {
409         winText.text = "You visited 22 rare sheep! Let's get to the finish zone!";
410         count = 22;
411     }
412     if (count > 22) // ensures that even if the count exceeds 22 at any point, the count still sets at 22.
413     {
414         winText.text = "You visited 22 rare sheep! Let's get to the finish zone!";
415         count = 22;
416     }
417 }
418
419 private string GetDebuggerDisplay()
420 {
421     return ToString();
422 }
423
424 }
```

Figure 3.1 Implemented Counter Repair

```
1 using System.Collections;
2 using System.Collections.Generic;
3 using System.Collections.Specialized;
4 using System.ComponentModel.Design.Serialization;
5 using UnityEngine;
6 using UnityEngine.AI;
7
8
9
10 public class flockBehavior : MonoBehaviour
11 {
12     public BitVector32 velocity { get; private set; }
13
14     [SerializeField] private float Speed = 5f;
15     [SerializeField] private float separationRadius = 1f;
16     [SerializeField] private float alignment = 1f;
17     [SerializeField] private float cohesion = 1f;
18     [SerializeField] private float separation = 1.5f;
19
20     private void Update()
21     {
22         BitVector32 flockingbehavior = CalculateFlockingBehavior();
23
24         Velocity = flockingbehavior;
25
26         Velocity = BitVector32.Section(Velocity, Speed);
27
28     }
29
30     private BitVector32 calculateflockbehavior()
31     {
32         flockAgent[] allAgents = FindObjectsOfType<flockAgent>();
33
34
35         BitVector32 alignmentMove = BitVector32.zero;
36         BitVector32 cohesionMove = BitVector32.zero;
37
38
39
40
41         int alignmentcount = 0;
42         int cohesioncount = 0;
43         int separationcount = 0;
44         foreach (FlockingAgent agent in allAgents)
```

Figure 3.2 AI Flocking Integration Test 1


```
43 int separationCount = 0;
44 foreach (FlockingAgent agent in allAgents)
45 {
46     if (agent != this)
47     {
48         float distance = Vector3.Distance(transform.position, agent.transform.position);
49
50
51         if (distance <= neighborRadius)
52         {
53             cohesionMove += agent.transform.position;
54             cohesionCount++;
55         }
56
57
58         if (distance <= separationRadius)
59         {
60             separationMove += transform.position - agent.transform.position;
61             separationCount++;
62         }
63     }
64 }
65
66 Vector3 flockingBehavior = Vector3.zero;
67
68
69 if (alignmentCount == 0)
70 {
71     alignmentMove /= alignmentCount;
72     flockingBehavior += (alignmentMove.normalized * alignmentWeight);
73 }
74
75
76 if (cohesionCount > 0)
77 {
78     cohesionMove /= cohesionCount;
79     flockingBehavior += ((cohesionMove - transform.position).normalized * cohesionWeight);
80 }
81
82
83 if (separationCount > 0)
84 {
85     separationMove += separationCount;
86     flockingBehavior += (separationMove.normalized * separationWeight);
87 }
```

Figure 3.3 AI Flocking Integration Test 2

```
67
68
69 if (alignmentCount == 0)
70 {
71     alignmentMove /= alignmentCount;
72     flockingBehavior += (alignmentMove.normalized * alignmentWeight);
73 }
74
75
76 if (cohesionCount > 0)
77 {
78     cohesionMove /= cohesionCount;
79     flockingBehavior += ((cohesionMove - transform.position).normalized * cohesionWeight);
80 }
81
82
83 if (separationCount > 0)
84 {
85     separationMove += separationCount;
86     flockingBehavior += (separationMove.normalized * separationWeight);
87 }
88
89 return flockingBehavior;
90 }
91
92
93 }
```

Figure 3.4 AI Flocking Integration Test 3

Bribiesca Eduardo First and Second Generation Hispanics with Religious Experiences: A Culturally Relevant Approach to Mental Health

Abstract

Hispanics are the largest minoritized group in the United States and are projected to be the majority by 2050 which also suggests an increase in mental health disparities that are seen in this group since Hispanics are some of the lowest-seeking individuals for mental health support (Caplan, 2019). Many Hispanics, particularly those that are first-generation and second-generation have the lowest use of mental health opportunities because of a variety of barriers such as stigma, financial components, and inadequate access to resources. This research intends to investigate the openness of culturally sensitive approaches to mental health and if those approaches would foster a willingness towards mental health seeking. Religion is one of the predominant aspects attached to the culture when examining Hispanic cultures. Approaches to Hispanic mental health with a culturally sensitive approach coupled with an integration of faith would be a method by which professionals can be agents to de-stigmatize mental health.

Eight participants were gathered to share their perceptions of a culturally sensitive approach to mental health with a foundation in religion. Participants expressed being open-minded towards approaches for mental health from a cultural perspective using methods that the participants are familiar with and recognize as part of their cultural development. Questions about religious affiliation were asked during a semi-structured interview. This research contributes towards bridging the area between religious Hispanics who are apprehensive to seek mental health opportunities and professionals who attempt to reach those populations that have some of the highest mental health disparities by implementing a culturally sensitive approach.

Introduction

Statement of Problem

Hispanics is a cultural minoritized group whose mental health is disproportionately impacted while also being a group that is the least likely groups to seek out mental health services for various reasons (Caplan, 2019). Stigma is one of the leading causes for the minimal mental health service utilization along with financial, language, and access barriers (Escobar-Galvez et al., 2023). The underutilization among Hispanics is a cause for great concern as the Hispanic population steadily grows as the largest minority group in the United States; the little access to mental health services will continue (Jensen, 2022). As stigma is one of the dominant concerns in seeking mental health resources among Hispanics, religious attitudinal beliefs have been perceived as a leading proponent of such stigmatization by researchers and self-identified religious individuals.

Purpose of Research

The purpose of my research is to discover an intentional approach for Hispanics to seek mental health opportunities that would be most appealing to them while being conscious of their cultural subscription. An important component of Hispanic culture is the espousal of religion to some degree, which can be through means of familial tradition (Moreno et al., 2017). The research seeks to de-stigmatize mental health seeking by means of culturally relevant approaches. Another goal among many is to address especially those who self-identify as religious and have adopted a negative connotation to mental health services leaving them feeling limited to outlets they can turn to mental health care.

Research Question

My research aims to answer the provided questions:

1. Do culturally relevant approaches to mental health resources in the Hispanic community offer a receptive attitude to seeking mental health opportunities?
2. Do religious beliefs among Hispanic communities push individuals away from seeking counseling/therapy outside of their religious belief system?
3. How do Hispanics perceive mental health within their experiences?
4. Where and from whom do Hispanics seek counseling opportunities?
5. Are there barriers to seeking mental health support? If so, what are they?
6. How do Hispanics address their mental health?

Definitions

- **Hispanic:** Those who have cultural or personal roots in Spanish-speaking countries.
- **Religious experience:** An experience or culmination of experiences that interact with religious beliefs (e.g. personal or familial practice of religion) not limited to tradition or customs.
- **Mental Health Opportunity:** The use of mental health services, resources, or any other form of information for the care of mental health wellbeing.
- **First-Generation Hispanics:** A first-generation Hispanic is someone whose birth country is different from the country they currently live in.
- **Second-Generation Hispanic:** A second-generation Hispanic refers to someone who has at least one parent whose birth country is different from the one they currently live in. The children live in the country in which they were born.

Hypothesis

I hypothesized that using culturally sensitive approaches to communicate mental health opportunities would motivate Hispanics to seek mental health services and resources. I also

hypothesized the implementation of culturally sensitive approaches would foster a change of attitude in mental health stigma where mental health is viewed positively rather than holding an immediate negative connotation.

Literature Review

Current State of Mental Health Among Hispanics

Many Hispanic individuals are already at a disadvantage when it comes to mental health because of several barriers that include stigma, financial factors, or the inability to access appropriate resources. Hispanics generally hold the perception of not speaking about mental health and, when they finally feel the need or cannot go any longer without addressing their mental health, they end up turning to the wrong place or at least a place that is not the most beneficial. They simply want to be heard by anyone who is competent and can offer any sort of help such as pastors or doctors or even other professionals including chiropractors (Olcoñ K & Gulbas, 2018). Turning to the professionals mentioned can be useful, but the best source of attention regarding mental health might be best addressed by a specialized mental health professional. This factor contributes to Hispanics not accessing adequate mental health resources.

In a study of 218 participants, it was found that financial barriers were a notable factor in what kept Hispanics from accessing mental health services. Over half of the 218 participants reported having some form of mental health struggle, but the majority also reported not seeking any resources or having a mental diagnosis and a reported 31 percent of Hispanics were not insured (Cohen et al., 2021; Escobar-Galvez et al., 2023). Financial barriers pose a real problem for Hispanics struggling with mental health because it can disqualify them from receiving mental health services simply because they cannot afford it; aggravating their mental health struggles.

Hispanics also have one of the lowest ethnic insurance percentages for having any sort of insurance, and Hispanic children are more likely to be uninsured as well when compared to non-Hispanic Whites (Berchick et al., 2019; Pabayo et al., 2021). Several concerns make mental health services difficult to maintain *if* those services are attained in the first place, such as inadequate resources.

Another concerning issue that holds Hispanics back from seeking mental health opportunities or the continuation of seeking help is the lack of appropriate resources. There is a language barrier that is pervasive between Hispanic clients and therapists who dominate the English language with competence. Briset et al. (2014) found that those who speak a minority language in their host country also seek mental health opportunities significantly less than those who proficiently speak the dominant language. Language barriers are an issue no matter what area of health is being sought out and many families and individuals struggle to access any sort of care let alone mental health care.

Insufficient resources that are provided in Spanish can give Hispanics greater trouble than other resource impediments such as having no insurance or physical access to services due to proximity (Williams et al., 2013). Not only are language barriers for Hispanics a burden to accessing mental health services but it can be harmful for Hispanic clients because there can be a misdiagnosis or medication doses can be inappropriately prescribed based on the description of the client. There may exist a misinterpretation of symptoms from the clinician or a misinterpretation of medication usage from the client among many other variations of situations that would be harmful for the client because of the language restriction between them both. This deterrent to mental health service seeking is compounded by others such as personal attitudes about mental health utilities.

Stigma is perhaps one of the most prominent limitations for Hispanics pertaining to discussions about mental health support. It is a common attitude that one is different because of circumstances viewed negatively in varying degrees. For example, when someone is diagnosed with depression, their perception may indicate that because they have a diagnosis they will be treated differently and almost cautiously making their depression a center of attention. The attitude can be if someone is notably different from the majority then they will to some degree be excluded. Vasquez et al. (2023) interestingly pointed out that not only are there associations between stigma and mental health service seeking from individuals who struggle with mental illness, but the families can also feel ashamed because of the stigma tied to mental illness and prevent them from seeking treatment. Providers can also add to the stigma implicitly by the attitudes they express when handling patients with mental health conditions such as regarding them as inferior or dangerous or incompetent (Rivera-Segarra et al., 2019).

Culturally Sensitive Mental Health Approach Effectivity

A culturally sensitive approach to mental health is an approach that caters to a specific person or group of people in a way that they can recognize and be comfortable with to facilitate openness and dialogue to mental health. For example, Levy et al. (2020) noted culturally sensitive approaches to mental health when it came to youth were a way to “bolster” confidence and provide the necessary courage to open up. Culturally attending to the inclinations of certain people can also allow for the processing of emotions and appreciation such as lyric writing or even listening to music and finding key lines in which the person relates (Levy et al., 2021). Every person has a cultural context in which they might feel most comfortable approaching certain topics or being approached about certain topics.

Culturally Sensitive Mental Health Approach for Religious Hispanics

A big part of Hispanic culture is the integration of religion into their culture, that it has become interwoven into the fabric of the culture itself. For example, in a general sense, many Hispanics celebrate Christmas in various forms given their degree of religious subscription. Some may not subscribe to the Christian religion at all but still celebrate those Holidays that are of a Christian religious origin, even if their religious subscription is not strong or present at all, there is still some cultural integration of religious traditions.

The largest religious subscription of Hispanics is that of Christianity which covers a large variety of denominations such as Catholicism, Protestantism, and other non-denominational groups. In 2022, Pew Research Center found that approximately 64% of Hispanics self-identified as Christian subscribers where 43% are Catholic, 15% Evangelical Protestant, and 6% Non-Evangelical Protestant (Krogstad, 2023). Approaching mental health considering this cultural integration of religious affiliation for Hispanics could be a method to de-stigmatize mental health among religious communities. Providing different resources to Hispanics in a manner that may seem comfortable and familiar, namely, with a religious foundation might allow for a gap to be filled in the mental health disparity among Hispanics. For instance, it was found that Catholics who engage in the sacramental practice of confession believed that they would be better off going to their priests for counseling over therapy with a psychologist (Moreno et al., 2017). Others also believed that any mental illness was in some way related to evil spirits and that would begin a process of marginalizing people because of their mental illness which is also associated with lack of faith (Caplan, 2019).

Method

Demographics (Participants)

The participants are all Cal Poly Pomona students who identified as Hispanic and are at least 18 years of age. Eight participants totals were gathered for this study of which four were female and four were male.

Inclusion Criteria

Participants in the research were included if they identified as (1) at least 18 years old; (2) first-generation or second-generation Hispanic; and (3) have had experiences with religion as described in the definitions portion.

Recruitment

I communicated my qualitative interview through various means such as word of mouth and emails. I had a conversation with the potential participants regarding the study's purpose and their potential fit in this study as well as through email exchanges. A purposive sampling approach was taken seeking particular individual participants based on their desirable experience outlined in the inclusion criteria.

Compensation

There was no direct compensation for the participants, however, they may learn about new resources regarding mental health specialists.

Procedure

I contacted my potential participants to talk about the study and informed them of what the study aimed to do. I figured out with them if they would still like to be part of the research study and answer any questions they may have before the official interview. I informed the participants that they are free to skip any interview questions they do not feel comfortable answering or end the interview entirely if they so wish. If they decided to proceed more questions followed about their experiences with mental health where several questions were

open-ended so that participants felt free to express themselves or respond uniquely. The qualitative interviews were one-on-one interviews of approximately 30 minutes to one hour in length to cover all the questions prepared.

Some of the questions asked during the interview included the following:

1. Under which major religious group do you most closely identify with?
2. To what extent has religion been part of your life?
3. How do you perceive mental health? What does it mean to you?
4. Was mental health talked about in your upbringing? If so to what extent?
5. Has religion in any way, shape, or form contributed to how you see mental health today? If so, how?
6. Were traditional ideals/beliefs part of your upbringing in areas like religion? For example “If one struggles with depression they must pray more to resolve it.”
7. What do you think “faith-based mental health” means when it comes to mental health?
8. How do you believe your family would react to the idea of faith-based mental health? The fusion of mental health and religion.
9. Within your religious beliefs, has mental health ever been a topic of discussion? (i.e. was mental health ever addressed in some capacity?) If so, how was it addressed?
10. Have you sought mental resources/services before?
 - a. If not, was it because of any barriers? Or did you simply feel no need to seek resources?
 - b. If you have reached out for mental health resources, did you experience any barriers to getting mental health services? (e.g. insurance, stigma, distance,

language, not knowing it was even a thing) Other: what is it? Was religion involved in some capacity?

11. Who have you sought mental health opportunities from? What places or outlets have you utilized to address your mental health? (In as much or as little detail as you feel comfortable sharing).
12. Was there anything said to you about mental health that stigmatized the perception of seeking or addressing mental health services? If you feel comfortable sharing, what sorts of statements were made in this regard?
13. Where or from whom would you feel most comfortable seeking mental health opportunities* from if you were seeking such opportunities? (*mental health resources/services)
14. Do you believe using mental health services/resources provided through churches or religious organizations might be helpful to destigmatize mental health for religious families/individuals? Why or why not?
15. How would you feel about mental health opportunities from sources that understand your culture and can speak to your intersecting identity? (All of the things that contribute to who you are as a person such as culture).
16. If any, are there things that would contribute to you not seeking out mental health opportunities today? What are they?
17. What factors can you see that may contribute to *other* religious individuals *not* seeking mental health opportunities?
 - a. What factors might contribute to *other* religious individuals seeking mental health resources?

18. Final thoughts/comments/concerns

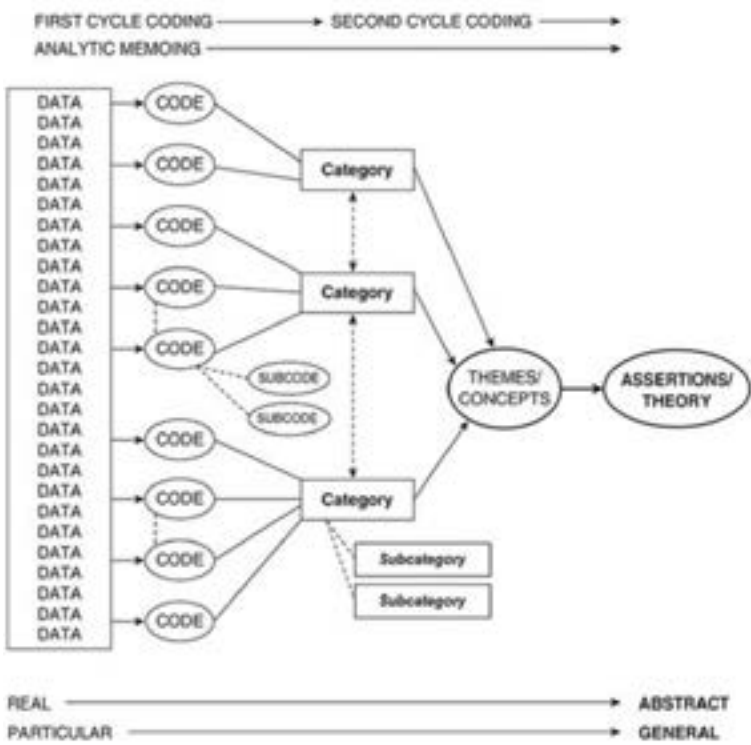
Data Analysis

A qualitative analysis was performed where I recorded the interviews with participants and recorded our session audibly if they approved and, if possible, the visual aspect if conducted via Zoom. I took handwritten notes to not distract participants with typing sounds. I used triangulation of data collection using several methods of obtaining my collected data (Creswell & Creswell, 2023). I wrote keywords I found during the interview process. I also went back and transcribed the dialogue with my participant making sure I had all the dialogue noted. I rewatched the recording to note any visual cues that I may have missed during the real-time interview. I coded the data I collected using Johnny Saldaña’s codes-to-theme model (Saldaña, 2021). The codes-to-theme model (Figure 1) helped to outline some of the common themes that appeared and assign the data into specific codes that were under major categories that led to the creation of certain themes (Saldaña, 2021).

I also followed up with my interview participants with the transcript dialogue to verify their words and perceptions as initially recorded. If there was misinterpreted information or responses, I addressed them with the participant during the follow-up email including the transcript dialogue. I found common concepts or attitudes relating to the subject matter in the interview and the transcript of the interview to conclude my findings. All materials used to document the interview information were strictly confidential and only I had access to all notes and recordings which were password-protected on my computer files.

Figure 1

A streamlined codes-to-theory model for qualitative inquiry



A streamlined codes-to-theory model for qualitative inquiry (Saldaña, 2021)

Results

Saldaña’s “Code to Theme Model” was utilized to code the data collected from the qualitative interviews. A total of eight individuals took part in this research study of which four were males and four were female. Many participants identified as religious, at least in experience, and had similarities in their responses. For example, it was found that, for many of them, religion had been present throughout their lives, some more visible while others less manifested. The majority (75%) revealed that traditional ideals were part of their experiences in areas of religion such as rigid views where religion is to be the only way through which life is built. The participants also shared that in their upbringing, mental health was not addressed, and neither was it addressed in their religious aspect of life. Many participants disclosed that providing faith-based mental health would create receptivity for religious Hispanics to seek out mental health resources if they were to be provided through their religious organizations. A large

percentage of participants (82%) said they had sought out mental health resources from professionals in the past and would feel most comfortable seeking out resources from a professional if they felt the need to. Over half of the individuals interviewed mentioned that stigma was a barrier to seeking mental health resources and some stated that they heard it referred to as “locos” or “crazy”. The evolved themes are displayed in Figure 2.

<i>Theme</i>	<i>% endorsing theme</i>	<i>Description of Theme</i>
Religious	84%	Traditional ideals growing up not addressing mental health influenced view of mental health
Open Space	94%	Participants shared providing space might make mental health-seeking comfortable by encompassing things they identify with.
Resource Seeking	63%	Sought mental health resources at some point
Barriers	63%	Expressed experiencing barriers such as mental health stigma, lack of support, and lack of client-counselor fit.
Mental Health Professional	82%	Participants indicated seeking professional mental health support and expressed their comfort in continuing to seek such support
Healthy State of Being	100%	Participants stated they view mental health as a healthy state of being
Religion and Mental Health	75%	Saw "faith-based mental health" as the integration of religion and mental health

Figure 2. Evolved Themes Table

Discussion

The purpose of this study was to explore culturally sensitive approaches such as faith-based mental health and ascertain if it would help create a path to de-stigmatize mental health for religious Hispanics, namely those who are either first or second-generation in the U.S. The responses from the interview participants suggest that there is an openness towards mental health for this population when resources can speak to their identity such as including a faith component. The participants suggested a strong familial influence on their lives which shows a collectivistic outlook. This was most notable when they virtually all stated how their family members such as parents, siblings, and extended family would be more open to the idea of mental health if it included a faith or religious component at its core. All the participants also shared a similar attitude when asked how they would feel about resources that recognize their identity including culture. Many stated that this lack of recognizing their identity when it came to mental health would act as a barrier to effective mental health seeking. Several individuals reported that among the barriers they might expect, stigma and financial barriers might be other concerns that other individuals might encounter. A common theme in the experiences of participants was the fact that mental health was not spoken of in their upbringing, but one participant mentioned the factors that influenced that situation. The individual mentioned how his mother had many siblings so mental health was never really considered because of the “struggles of financially supporting nine kids.” Other pressing concerns took over such as supporting and feeding several people.

The findings from the study’s interviews support the initial hypothesis that when presented with culturally sensitive approaches to mental health, religious Hispanics, in this case, would be more open to the idea of mental health because familiarity exists with this approach. In

other words, when individuals found that there could be resources that can address their identity such as cultural background, they expressed being more open to the idea of seeking out mental health resources. Participants expressed their thoughts on de-stigmatizing mental health by simply providing space and “talking about it” as some expressed. It seemed that religion or faith was the experience of the individuals’ lives and the lives of their families which was relied upon actively. If this characteristic, namely religion, is something that has become ingrained in the lives of the participants and their families, then providing resources for mental health would certainly be a place to start the goal of de-stigmatizing mental health. This method might normalize mental health once shown to be supported by their religious groups, especially for those who share a more traditional frame of thinking regarding religion. One participant reported when asked how their family would react to faith-based mental health, “I definitely think they would be a lot more open as opposed to maybe seeing a counselor/therapist because there are aspects like maybe that they can cling onto as opposed to cling on to nothing.” They referred to the fact that faith-based mental health would have a faith component which might make their family members more comfortable and open to the idea of mental health. Similarly, another participant responded to the same question about how their family would feel, “more comfortable and respect talking to a priest more than to a therapist.” Since there seems to be comfortability in religion, speaking about mental health through resources that encompass faith would suit those who have religious subscriptions.

Limitations

A limitation that may have been present was the possibility of a bias because I identify as a second-generation Hispanic and grew up with a religious background which may influence the way I perceive my participants’ answers. Since the participants are CPP students, some of whom

are psychology majors, they are more likely to be open to mental health opportunities and so the collected data may show a large openness to mental health discussions in general. As the interviews were conducted via Zoom the body language was not as explicit as might be in person and so there may have been gestures that could not be recognized because only a portion of the individuals were captured. As with much qualitative research, difficulties present themselves at the hour of coding data such that when participants all have unique responses there is a challenge in trying to capture all the responses in a single answer. There are responses that were expressed by a minority of individuals that were not shared by the rest of the participants, but that does not mean other people in the general population would not also share the same response. In a similar vein, there must be caution if trying to generalize these results because the responses from each participant may be uniquely their own depending on their experiences. There may be overlap in experiences, but typically they may not generalize. Instead, these findings add to the body of knowledge to give more insight as to why and how culturally sensitive approaches to mental health can facilitate well-being.

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Brown Sergio

Development and Performance Evaluation of an Autonomous Navigation Robot with Advanced Hardware Integration for Campus Guidance and Beyond

1. Background	Robots have become increasingly integrated in various fields and applications, including autonomous navigation and control. With the integration of advanced hardware like Arduino microcontrollers, Raspberry Pi microcontrollers, GPS, Ultrasonic sensors, and LIDAR the significance of enhancements are seen by the robot’s capabilities. This research and application of hardware used aims to develop a versatile robot capable of precise navigation, obstacle detection and avoidance, and global positioning.
2. Motivation	The motivation for this project stands in the need and demand for autonomous and intelligent robots and integrating this into a school campus setting. Building a robot with this complexity aims to be used in a way of becoming an interactive guide for students on campus. By combining the Arduino and Raspberry PI microcontrollers with the LIDAR, GPS, and ultrasonic sensors a platform can be created to build and test an autonomous robot carrying out complex tasks. The project’s main goal is to have an interactive autonomous robot serve as a campus aid for students and faculty.
3. Literature Review	3.1 Arduino Microcontrollers:

Arduino Microcontrollers have gained significant recognition and popularity due to their more beginner friendly use and high versatility. Microcontrollers provide a fundamental basis for operating complex robotic systems, offering a broad range of compatible sensors and actuators.

In S Deepa Nivethika “Intelligent Movement Tracking Robot” he emphasizes the successful implementation of a Human-following robot prototype, highlighting its detection capabilities, operational effectiveness, and the integration of various sensors. The project's methodology involved rigorous testing to identify and rectify algorithm flaws. The collaborative efforts of the group were tested in terms of communication, cooperation, and understanding of electro-mechanical systems. This aligns with utilizing Arduino in an autonomous robot navigating a school campus. The discussed prototype's reliance on motors, Arduino, and diverse sensors for obstacle detection and path adjustment resonates with the theme of the Arduino-based autonomous robot in a school setting. Both projects underscore the importance of effective algorithm implementation, rigorous testing, and interdisciplinary collaboration in the development of successful robotic systems for practical applications.

3.2 Ultrasonic Sensor (HC-SR04):

An Ultrasonic Sensor like the HC-SR04 is widely used in the application of distance measurement and obstacle avoidance. The sensor works on the principle of sending and receiving sound waves, applying this towards navigation. The HC-SR04 sensor can be programmed to the arduino by simply using this modified version of the PING example on the sensors section:

```
const int trigPin = 7;
const int echoPin = 8;

void setup() {
  // initialize serial communication:
  Serial.begin(9600);
  pinMode(trigPin,OUTPUT);
  pinMode(echoPin,INPUT);
}

void loop() {
```

```
long duration, inches, cm;

// The HC-SR04))) is triggered by a HIGH pulse of 2 or more microseconds.
// Give a short LOW pulse beforehand to ensure a clean HIGH pulse:

digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// The same pin is used to read the signal from the HC-SR04))) : a HIGH pulse
// whose duration is the time (in microseconds) from the sending of the HC-SR04
// to the reception of its echo off of an object.

duration = pulseIn(echoPin, HIGH);

// convert the time into a distance
inches = microsecondsToInches(duration);
cm = microsecondsToCentimeters(duration);

Serial.print(inches);
Serial.print("in, ");
Serial.print(cm);
Serial.print("cm");
Serial.println();

delay(100);
}

long microsecondsToInches(long microseconds) {
  return microseconds / 74 / 2;
}

long microsecondsToCentimeters(long microseconds) {
  // The speed of sound is 340 m/s or 29 microseconds per centimeter.
  // The ping travels out and back, so to find the distance of the object we
  // take half of the distance travelled.
  return microseconds / 29 / 2;
}. Dele Zacheaus Yanmida highlights in “Obstacle Detection and Anti-Collision Robot Using Ultrasonic Sensor” the successful implementation of an obstacle detection robot using an HC-SR04 ultrasonic sensor and an ATmega 2560 microcontroller. The evaluation focused on the robot's ability to detect obstacles at varied distances, with particular attention to a 50 cm obstacle distance where the robot demonstrated minimal error (3.6%) in avoiding collisions. This finding can be valuable for implementing an autonomous robot in a school campus, showcasing the effectiveness of the mentioned sensor and
```

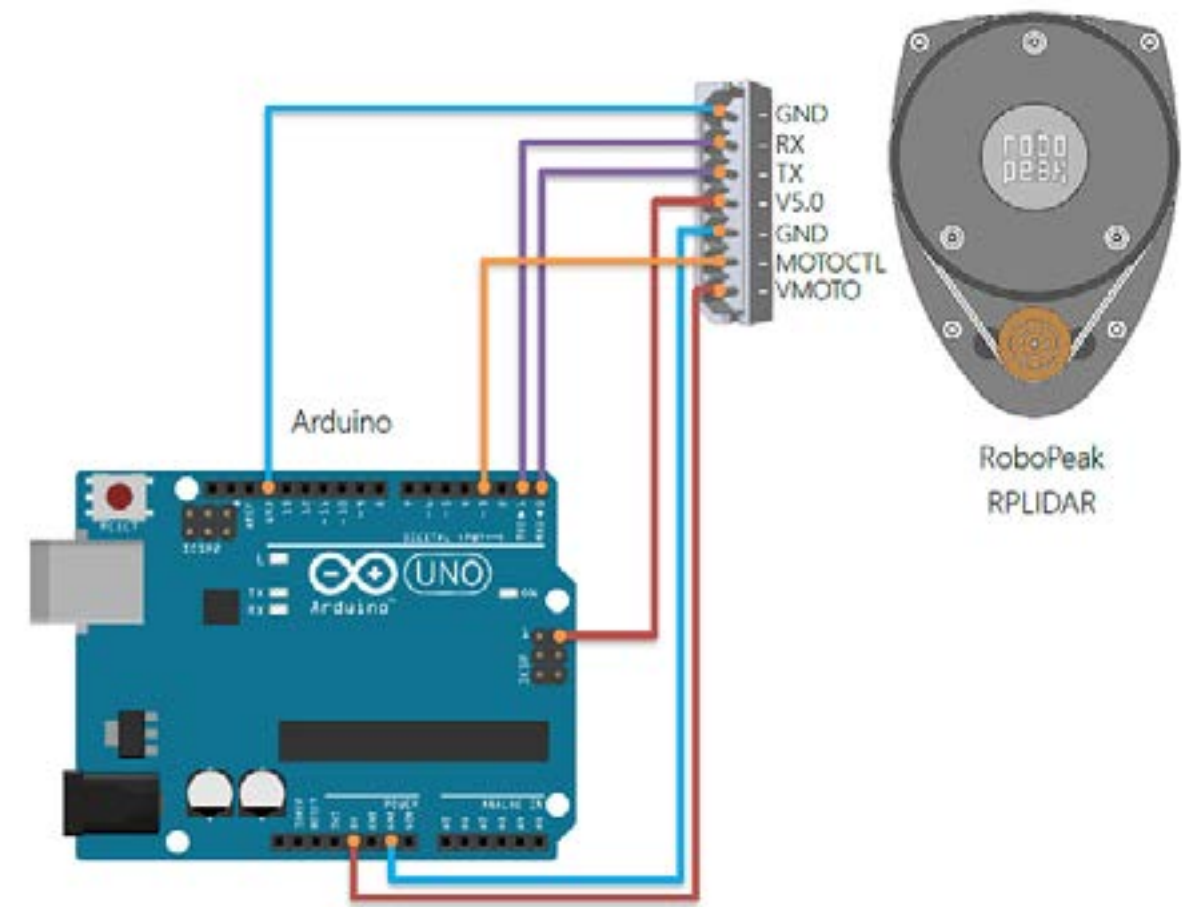

microcontroller in enhancing the robot's obstacle avoidance capabilities. The study provides practical insights that can inform the design and performance expectations of autonomous robots.

3.3 GPS (Global Positioning System):

GPS bears a crucial role in determining the robot’s exact location with high accuracy. This enables autonomous navigation, mapping, and real-time tracking.

3.4 LIDAR (Light Detection and Ranging):

LIDAR technology utilizes laser beams to measure distance and expand on this by creating a detailed map of its nearby surroundings. LIDAR is pivotal for the use of obstacle detection and mapping in robotics applications. The following wiring diagram is used when connecting the RPLIDAR-A1 to an Arduino uno:



The ZIP file in order to access the LIDAR library in Arduino IDE can be found in the following website in the resources section: <https://dronebotworkshop.com/getting-started-with-lidar/>. After download ZIP file the library can be accessed by first opening the Arduino IDE then within the sketch tab going into include library then adding ZIP library and then selecting the folder that was download and clicking RP LIDAR DRIVER. After installing library the example simple connect on RPLIDAR section is a template to write your own code for the LIDAR, the following is the example simple connect:

```
// This sketch code is based on the RPLIDAR driver library provided by RoboPeak
#include <RPLidar.h>

// You need to create an driver instance
RPLidar lidar;

#define RPLIDAR_MOTOR 3 // The PWM pin for control the speed of RPLIDAR's motor.
```

```

// This pin should connected with the RPLIDAR's MOTOCTRL
signal

void setup() {
  // bind the RPLIDAR driver to the arduino hardware serial
  lidar.begin(Serial);

  // set pin modes
  pinMode(RPLIDAR_MOTOR, OUTPUT);
}

void loop() {
  if (IS_OK(lidar.waitPoint())) {
    float distance = lidar.getCurrentPoint().distance; //distance value in mm
    unit
    float angle    = lidar.getCurrentPoint().angle; //anglue value in degree
    bool startBit = lidar.getCurrentPoint().startBit; //whether this point is
    belong to a new scan
    byte quality = lidar.getCurrentPoint().quality; //quality of the current
    measurement

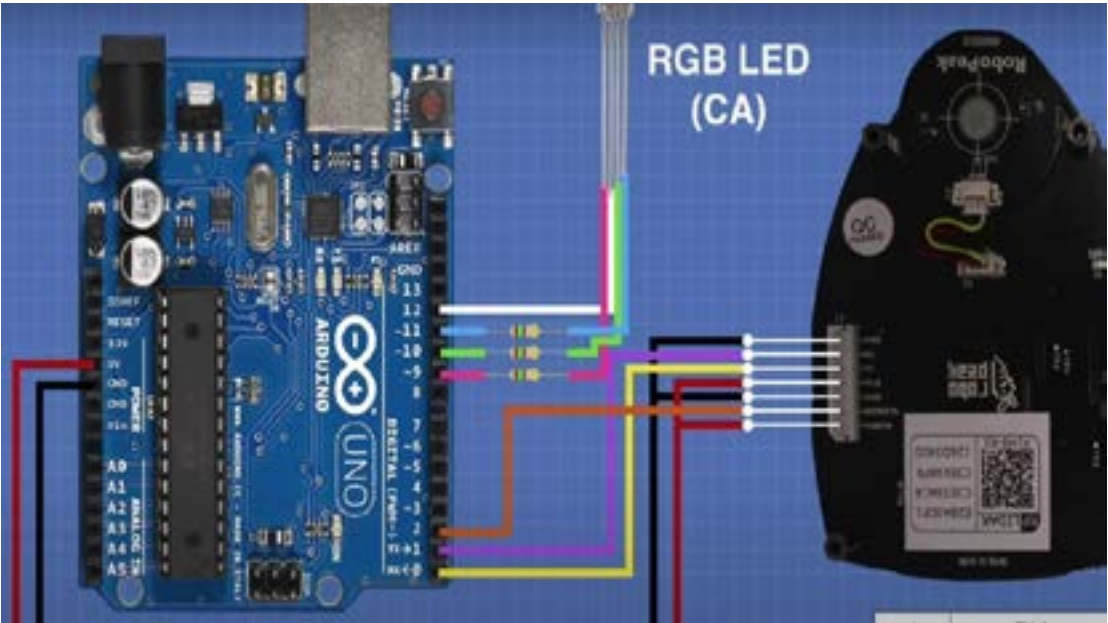
    //perform data processing here...

  } else {
    analogWrite(RPLIDAR_MOTOR, 0); //stop the rplidar motor

    // try to detect RPLIDAR...
    rplidar_response_device_info_t info;
    if (IS_OK(lidar.getDeviceInfo(info, 100))) {
      // detected...
      lidar.startScan();

      // start motor rotating at max allowed speed
      analogWrite(RPLIDAR_MOTOR, 255);
      delay(1000);
    }
  }
}
```

The next example distance to color shows the LIDAR communicating with the LED light by changing the LED color when it detects a new object, the following shows the wiring diagram for an Arduino uno r3, RGB LED, and RPLIDAR-A1:



After connecting the Arduino uno r3 to RGB LED AND RPLIDAR-A1 the following code distance_to_color can be used compiled from the examples section on the LIDAR library:

```

// This sketch code is based on the RPLIDAR driver library provided by RoboPeak
#include <RPLidar.h>

// You need to create an driver instance
RPLidar lidar;

// Change the pin mapping based on your needs.
///////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
#define LED_ENABLE 12 // The GPIO pin for the RGB led's common lead.
                        // assumes a common positive type LED is used
#define LED_R      9  // The PWM pin for drive the Red LED
#define LED_G      11 // The PWM pin for drive the Green LED
#define LED_B      10 // The PWM pin for drive the Blue LED

#define RPLIDAR_MOTOR 3 // The PWM pin for control the speed of RPLIDAR's motor.
                        // This pin should connected with the RPLIDAR's MOTOCTRL

signal
/////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

#define NEO_RGBSPACE_MAX (byte)(200L*255/360)
int _r, _g, _b;

//Set current RGB with the hue: HSV(hue, x, x)
void hue_to_rgb( _u8 hue)
{
  /*`
```

```

    Hue(in Degree):  0 (RED) ----> 60 (Yello) ----> 120 (Green) ---->
360
    Hue'(fit to _u8):0      ----> 60/360*255 ----> 120/260*255 ---->
255
    */

    //convert HSV(hue,1,1) color space to RGB space
    if (hue < 120L*255/360)  //R->G
    {
        _g = hue;
        _r = NEO_RGBSPACE_MAX - hue;
        _b = 0;
    }else if (hue < 240L*255/360)  //G->B
    {
        hue -= 120L*255/360;
        _b = hue;
        _g = NEO_RGBSPACE_MAX - hue;
        _r = 0;
    }else //B->R
    {
        hue -= 240L*255/360;
        _r = hue;
        _b = NEO_RGBSPACE_MAX - _r;
        _g = 0;
    }
}

void displayColor(float angle, float distance)
{
    //1. map 0-350 deg to 0-255
    byte hue = angle*255/360;
    hue_to_rgb(hue);

    //2. control the light

    int lightFactor = (distance>500.0)?0:(255-distance*255/500);
    _r *=lightFactor;
    _g *=lightFactor;
    _b *=lightFactor;

    _r /= 255;
    _g /= 255;
    _b /= 255;

    analogWrite(LED_R, 255-_r);
    analogWrite(LED_G, 255-_g);
    analogWrite(LED_B, 255-_b);
}

```

```

void setup() {
    // bind the RPLIDAR driver to the arduino hardware serial
    lidar.begin(Serial);

    // set pin modes
    pinMode(RPLIDAR_MOTOR, OUTPUT);

    pinMode(LED_ENABLE, OUTPUT);
    pinMode(LED_R, OUTPUT);
    pinMode(LED_G, OUTPUT);
    pinMode(LED_B, OUTPUT);

    digitalWrite(LED_ENABLE, HIGH);

    analogWrite(LED_R,255);
    analogWrite(LED_G,255);
    analogWrite(LED_B,255);
}

float minDistance = 100000;
float angleAtMinDist = 0;

void loop() {
    if (IS_OK(lidar.waitPoint())) {
        //perform data processing here...
        float distance = lidar.getCurrentPoint().distance;
        float angle = lidar.getCurrentPoint().angle;

        if (lidar.getCurrentPoint().startBit) {
            // a new scan, display the previous data...
            displayColor(angleAtMinDist, minDistance);
            minDistance = 100000;
            angleAtMinDist = 0;
        } else {
            if ( distance > 0 && distance < minDistance) {
                minDistance = distance;
                angleAtMinDist = angle;
            }
        }
    } else {
        analogWrite(RPLIDAR_MOTOR, 0); //stop the rplidar motor

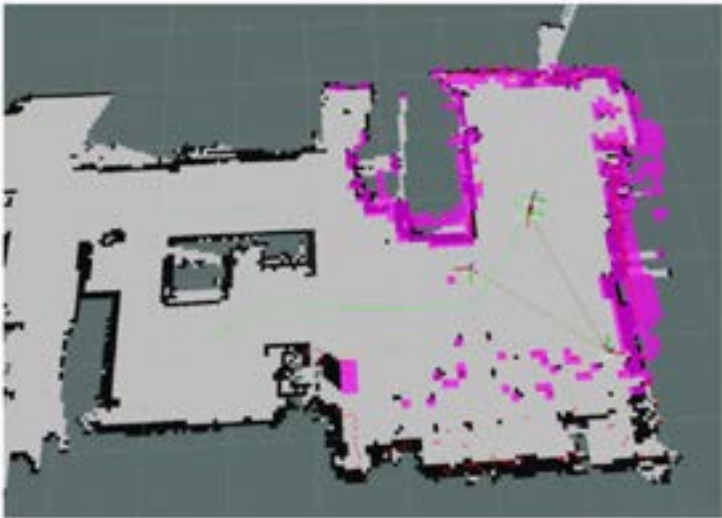
        // try to detect RPLIDAR...
        rplidar_response_device_info_t info;
        if (IS_OK(lidar.getDeviceInfo(info, 100))) {
            //detected...
            lidar.startScan();
        }
    }
}

```



```
    analogWrite(RPLIDAR_MOTOR, 255);  
    delay(1000);  
  }  
}  
}
```

In Sherwin John Dignadice “Application of Simultaneous Localization and Mapping in the Development of an Autonomous Robot” he evaluates the feasibility of an indoor service robot equipped with 2D LiDAR and odometry for implementing SLAM. The use of Gmapping for map generation, with default parameters and careful slow navigation, resulted in reliable scans and consistent map creation, as depicted in the following figure:



The mapping process involved positioning the robot in the desired origin, followed by slow navigation to optimize laser and odometry data fusion using Gmapping. Teleoperation reliability was assessed through manual operation using the Navigation Stack, with subsequent autonomous navigation using 2D Nav Goals in Rviz. Feedback from Rviz proved highly reliable, attributed to the incorporation of Adaptive Monte Carlo Localization (AMCL) within the ROS Navigation Stack. AMCL compensates for dead reckoning errors by continuously comparing laser data with the generated map during teleoperation, correcting drifts and ensuring accurate tracking, as discussed in the previous figure. The article also addresses static and dynamic obstacle avoidance. Successful remapping of the path plan and responsiveness to obstacles within the LiDAR's scanning range emphasize the system's robustness. This research is

pertinent to a school campus setting, as it highlights the efficacy of LiDAR-equipped robots for autonomous navigation, mapping, and obstacle avoidance. The methods described offer valuable insights for the development of autonomous robots in educational environments, showcasing the potential for enhancing campus services or educational experiences through robotics technology.

4. Methodology

The development and assembly of the robot will involve the following steps:

- Hardware assembly: The development of an aluminum chassis will be suited to hold the electrical components of the robot. Inside the chassis the Arduino uno r3 will be connected to two brushless motor drivers capable of supporting a minimum of 48 Volts and 15 Amps to each motor. The RPLIDARA1M8-R6 will be placed in the aluminum chassis and be connected to an Arduino uno r3. The Ultrasonic sensor (HC-SR04) will be connected to an Arduino uno as well and will be assembled in a suitable location in the Aluminum chassis. The Raspberry Pi microcontroller will be used for GPS.
- Potential challenges through hardware assembly include synchronization errors in the robot when operating a server using various data collected from the hardware assembled. Another challenge can be manufacturing a chassis that aligns all the sensors and microcontrollers to it's full potential without getting any potential errors.
- Software Development: The microcontrollers in the robot will be programmed using the Arduino IDE and ROS (Robot Operating System) to control and read the robot's movements, process data from the sensors used in the robot, and interface with the GPS.
- Potential challenges during software development include developing programs to synchronize and operate microcontrollers and sensors, also developing a robot operating system (ROS) to control and monitor the robot using one server.

- Navigation Algorithms: Applying and developing algorithms for obstacle detection, path planning, and global positioning.
- Testing and Evaluation: Rigorously testing the robot’s performances and capabilities in different scenarios will be conducted to achieve fine tuning for the system used to have optimal results. Different circumstances will be applied as the robot serves to navigate a school campus which present and complex environment.
- Data Analysis: Analyzing the data received by the robot to assess its performance and possible applications presents a value in understanding the performance of the robot and troubleshooting any areas that might need improvement.

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Buck Cameron

Factors Driving Overconsumption Amongst Fashion Consumers

I. Abstract

Overconsumption is defined as the process of consuming more than necessary at a rate exceeding average consumption levels. This study investigates the elements contributing to the increase of overconsumption in the fashion industry, a sector known as one of the largest polluters worldwide, and how we as consumers can reduce it. This study researched variable relationships between the perception of social media, emotional attachment to fashion belongings, lack of knowledge regarding environmental/social consequences, and self-esteem regarding purchasing habits. Within this study, a quantitative research design was used with an emphasis on descriptive research to find these relationships. After data was collected, the data was analyzed and interpreted from an online survey sent out to California State Polytechnic University, Pomona students. This research aims to provide a comprehensive analysis of the driving forces behind overconsumption, seeking to contribute to the discourse on sustainable consumption and ethical responsibilities within the fashion industry.

Keywords: *Overconsumption, social media, emotional attachment, environmental and social consequences, self-esteem.*

II. Introduction

Research Question:

What are the factors (drivers) influencing the increase of overconsumption in the fashion industry?

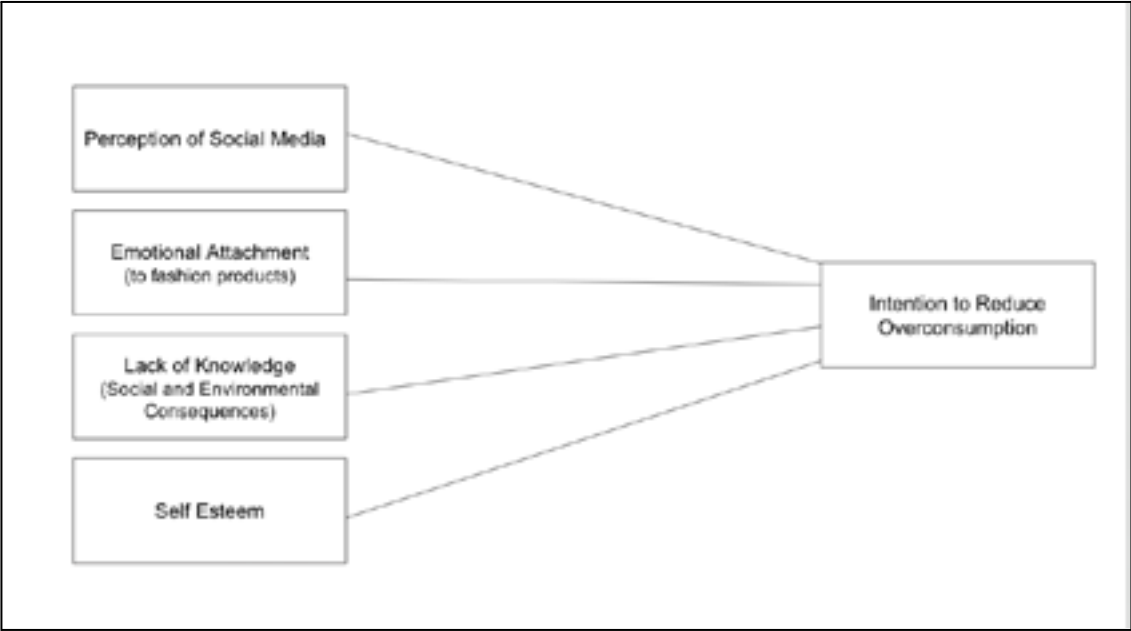
Fast fashion is one of the largest polluters in our world, known for creating fashion waste, water pollution from textile dyeing, and supporting a business model that feeds overconsumption. Fast fashion introduces new products more frequently, rather than just one line per season, thus encouraging consumers to buy more. Overconsumption refers to the process of

consuming more than one needs at an increased rate compared to average consumption rates.

The fashion industry has been linked to not only overconsumption, but also other issues such as the welfare of factory workers, and detrimental environmental impacts. Consumption is aligned with consumer waste at 10.5 million tons per year (Shoaff, 2020). Regarding overconsumption waste, a consumer’s attitude towards fashion is linked to their emotion and behavior. As fashion gives individuals the ability to express themselves, the fast fashion business model drives consumption, which the consumer is often unaware of. Shopping purchases can stem from a person's emotions as something to make themselves feel better, relieve stress, or boost self-esteem. This phenomenon is something that only makes someone feel happy for a small moment until they feel like they need to relieve themselves again by purchasing new items (Rosely, et al., 2023).

To fully understand why overconsumption occurs, we need to determine how consumer behavior is affected by the accelerated trend cycles of fast fashion, as well as the effects of social media and fast fashion marketing on consumer behavior. Social media is another platform that sells products that are constantly thrown in social media users' faces showing brands, promotions, discounts, and popular trends. With the rise of social media platforms such as Instagram and TikTok, the speed at which fashion trends cycle through has increased dramatically (Liu, 2021). Generation Z is the target group of overconsumption and engages in it more than other generations although they might be more aware of the landfill effects produced by the fashion industry, they are affected by social media influencers and advertisements on 30 Instagram, TikTok, and YouTube (Gutierrez, 2022). After COVID-19, Gen Z sparked e-commerce sales and these sales have continued since, more people now prefer to shop online rather than in-store (Siregar et al., 2023). Shein is one of the largest and fastest-growing fast

fashion companies on social media over the past few years. Consumers may recognize this from “Shein Haul” videos, in which an influencer will create content showing off their massive haul of clothing and accessories from the brand, often worth upwards of \$500 to \$1,000. This is no longer out of a need for trendy, affordable clothes, but of “desperate attempts to maintain online relevancy” (Lloyd et al., 2022). With rising concerns of society trying to maintain frequently changing trends comes negative impacts on the environment. The textile industry is thus one of the fastest-growing waste-producing industries in the world and fast fashion deeply affects the landscape of the clothing business with severe repercussions on the environment (Armstrong et al., 2015, as cited in Mason, et al., 2022). With the pressure to keep up with trends and the marketing tactics used to encourage overconsumption, society has fallen victim to an unsustainable business model that raises serious environmental and ethical concerns (Carlsbad, 2021). To deal with the issue of overconsumption there are ways of having a better outcome like making better shopping behaviors or shopping from sustainable brands. One company specifically, H&M has begun sustainable actions through the ‘Conscious Collection Line’ which focuses on utilizing organic materials and plans to replace the entire product range with new sustainable materials by 2030 (Yoon et al., 2020). To make a change in the fashion industry’s overconsumption practices, consumers need to be more mindful when purchasing. Overall, less consumption leads to fewer negative impacts (Gadhavi & Sahni, 2020). The goal of this research study is to utilize the variables of perception of social media, emotional attachment to fashion belongings, lack of knowledge regarding environmental/social consequences, and self-esteem regarding purchasing habits, to conclude how consumers can reduce overconsumption. The variables all relate to the overall objective presented within this research paper, the intention to reduce overconsumption.



(Fig. 1)

Figure 1 is the model developed to demonstrate how each of our variables connects to the overall intention of reducing overconsumption in the fashion industry.

III. Literature Review

The Norm Activation Theory focuses on three antecedents for consumer prosocial behaviors which are described as an awareness of consequences, acknowledgment of responsibility, and personal norms. Awareness of consequences refers to individual awareness of negative consequences for not acting pro-social. Acknowledgment of responsibility refers to the feeling of responsibility for the negative consequences of not acting pro-social. Personal norms speak to an individual's moral obligation to act pro-social in ways that align with individual value systems (Abutaleb et al., 2022). The variables we intend to focus on regarding this theory are the perception of social media influencers, emotional attachment to fashion products, lack of knowledge regarding environmental and social consequences, and self-esteem regarding purchasing habits. The perception of social media is related to an individual's perception of whether people important to them think they should or should not perform a certain behavior, in

this case, the purchasing of fashion-related goods. If a consumer has a positive attitude towards their favorite social media influencer, it is more likely that they will engage in overconsumption. Emotional attachment to fashion belongings creates a lasting bond between the garment and the consumer. With this feeling, consumers are more likely to decrease impulsive purchases and increase slow fashion which creates an environmentally friendly relationship with fashion. Lack of knowledge regarding social and environmental consequences is a leading factor in overconsumption. Consumers are not aware of the consequences and impact the fashion industry has on our world. To reduce overconsumption, consumers need to be more knowledgeable about the consequences stemming from the fashion industry and purchase in an environmentally friendly way. Self-esteem is one of the variables that has to do with why consumers perceive themselves are engaging in overconsumption. People who have low self-esteem tend to buy more clothes and most of the time these types of clothes are from fast fashion brands that aren't good quality also causing more people to buy more. These variables are tendencies we have control of and need to manage to make a change regarding overconsumption. Each variable gives a glimpse into different aspects of the theory that all relate to the overall goal of reducing overconsumption.

1. Perception of Social Media Influencers

Regarding fashion purchasing behavior, a consumer's attitude is dependent on their purchasing habits, for a positive attitude towards a specific behavior means someone is more likely to engage in it. Thus, if consumers perceive buying new clothing items frequently as positive, enjoyable, or beneficial, they're more likely to indulge in overconsumption. Factors that influence these attitudes include the pleasure derived from shopping, the self-confidence boost from wearing trendy outfits, or the perceived value in owning multiple clothing items. The proliferation of social media platforms and social media influencers (SMI) promotes a constant

showcase of new styles, which can pressurize followers to regularly update their wardrobes to keep up with the latest trends. If a consumer has a positive attitude toward their favorite SMI, it is more likely that they will engage in this form of social media marketing, as the media's portrayal of celebrities and their frequently changing wardrobes can set an aspirational standard for the public. Subjective norms in this context are an individual's perception of whether people important to them think they should or should not perform a certain behavior. If peers, family, or SMIs frequently purchase and showcase new fashion items, it can create normative pressure for the individual to do the same. This phenomenon can be depicted in any “Shein haul” video, in which fashion content creators showcase and review products sent to them from a fast fashion brand. The role of the social media influencer in this scenario is to market Shein’s product to their viewers and is not out of a need for clothing, but rather a “desperate [attempt] to maintain online relevancy” (Lloyd et al., 2022). If a consumer’s society and culture around them involve staying up-to-date with fashion trends, individuals are likely to feel a stronger compulsion to buy new clothing items regularly, which can be a driver of overconsumption. Even with regards to ‘eco-friendly’ fashion influencers, there exists a “proposed attitude-behavior gap,” in which these influencers “are ultimately continuing to push overconsumption of products, [whether] sustainable or not” (Short, p.5, 2022). Consumers fuel fast fashion, and companies use this in their business model by creating more products than ever before, conditioning consumers to be “circular consumers,” in which they are stuck in a “continuous cycle of purchasing clothing, disposing of the clothing, and then buying new clothes again” (Webster, 2023).

H1: Consumers who need to follow Social Media Influencers (SMI) that frequently post about new fashion items will have a negative relationship with the intention of reducing overconsumption.

2. Emotional Attachment to Fashion Belongings

A consumer’s attitude towards fashion is linked to their emotions. Emotional attachment to fashion belongings has driven consumers to practice sustainability and reduce overall consumption. The emotional attachment stems from the garment and the consumer which creates a bond that presents feelings of comfort, happiness, and security (Park et al., 2010; Thomson et al., 2005; So, et al., 2013). A consumer’s emotional attachment can reduce overconsumption and impulsive buying by creating a longer-lasting bond with their garments. The wearers’ attitude alone is enough to nurture or undermine the longevity of their relationship with a garment (Ferreira & Neto, 2023). With this bonded feeling, consumers are more careful with their garments and are more likely to make changes to extend their functional life, and acceptance of their appearance—either new or old and worn—are examples of how wearers overcome difficulties and enjoy fashion at a slower pace, beyond the buying experience (Fletcher 2016; Clark 2019; Ferreira & Neto, 2023). With this in mind, consumers are more likely to practice sustainability by repairing and repurposing their clothes to extend their lifetime, helping reduce the environmental impacts of the fashion industry (Hale & Zhang, 2022). Consumers with an emotional attachment to their fashion belongings not only create a lasting relationship with their garments but also introduce slow fashion through the decrease in fashion purchases. Overall, the feeling of emotional attachment to fashion belongings promotes sustainability and reduces impulsive purchases which portrays an environmentally friendly relationship to fashion.

H2: Emotionally attached consumers have longer-lasting relationships with their fashion belongings which reduces overconsumption.

3. Lack of Knowledge -Environmental/Social

The garment industry is now the second largest polluter in the world (Shoaff, 2020). Not

only is the fashion industry bad for the environment with air and water pollution, the use of toxic chemicals, ozone depletion, and erosion of agricultural soils, but it is also known for treating its workers poorly. The fashion industry is also known for utilizing low-wage countries for labor, child labor, long working hours with minimal breaks, and bad safety standards (Roozen, 2020). Consumers are becoming more aware of the social and environmental consequences that stem from the fashion industry. As consumers become more educated about how the fashion industry impacts our world, they want more sustainable and environmentally/socially friendly practices. This leads to one of two options: greenwashing, or fulfilling the promise of environmentally friendly practices. Greenwashing campaigns are typically utilized by businesses to showcase to consumers that they are committing to having a sustainable supply chain, even when they are not completely becoming sustainable, just changing the things consumers hear and know about (Shoaff, 2020). An uneducated consumer is the industry's ideal customer. As of 2020, most consumers need to be educated about the negative impacts caused by the fashion industry and are a large part of the issue regarding environmental impacts (Wu, 2020). More consumers over the past few years are learning of these impacts and are demanding change. Consumers are deciding more carefully on the products they are purchasing, but this is not enough action to make a change. There is a gap between intention and behavior that exists on this topic, of why consumers may intend to purchase eco-friendly or sustainable but do not follow through (Diddi et al., 2019). This gap must be mended as more and more consumers become educated about the fashion industry's dark side, the hope for fixing some of these issues is in the future. When more consumers are aware, then there is the possibility of change for these negative consequences as well as a reduction of overconsumption, as the more clothing produced and thrown out, the more our planet is affected.

H3: Knowledge of social and environmental consequences of fashion is positively related to the intention to reduce overconsumption.

4. Self-Esteem -Purchasing Habits

Overconsumption is something that can affect a consumer's self-esteem when purchasing clothes from fashion stores. Self-esteem is how we value and perceive ourselves. It's based on “our opinions and beliefs about ourselves”, which can feel difficult to change. We might also think of self-esteem as self-confidence (Mind, 2022). For certain people wearing certain clothing can give a person a confidence boost, be in a better mood, and enhance self-worth so they might think they need to buy a lot of clothes to increase self-esteem (Seung-Mcfarland, 2022). People dress the way they are feeling and dressing is how people can show what kind of esteem or mood they have. Items are priced so low that it’s hard for consumers to say no and easy for them to constantly cycle hard-worn pieces out of their closets for new, interesting styles (Cameya, 2022). Fast fashion can make a consumer believe that they-need to shop more and more to stay on top of trends, creating a constant sense of need and ultimate dissatisfaction. The trend has also been criticized on intellectual property grounds, with some designers alleging that retailers have illegally mass-produced their designs (Perry, 2018). These fast fashion clothing are made with Cheap, low-quality materials like polyester, causing clothes to degrade after just a few wears and get thrown away (Rauturier, 2022). When clothing gets disposed of it creates waste and causes harm to the environment.

H4: Consumers with low self-esteem are negatively related to the intention of overconsumption.

IV. Methodology

We utilized a quantitative, descriptive design for this research. Some questions had a five-point Likert-type interval scale. The survey was coded on an online platform, Qualtrics. Variables of this research were measured by pre-existing scales adapted from previous studies.

The target group for responses from our survey was Generation Z. Generation Z consists of age ranges born between 1998 and 2012 (Meola, 2023). We gathered responses by sending this survey to friends, clubs, outside-of-school groups, discords, class pages, and social media pages as well as posting on our accounts. We only surveyed participants 18 years and older. We had a filtering question that filters out any participants other than those within the Generation Z age range. This study allowed us to analyze if consumers depending on age range are aware of what overconsumption is by a series of questions that are given for them to choose.

Measurements:

Each variable was measured on 3-4 question scales adapted from previous research. To measure the perception of social media influences, 6 items scale from a five-point scale was adapted from Bruner, 2015; Pellegrino et al., 2022). These questions were measured on a five-point Likert type strongly disagree to strongly agree on the scale. To analyze the emotional attachment to fashion belongings, a five-point Likert-type scale questions was created that ranged from strongly disagree, somewhat disagree, neutral, somewhat agree, and strongly agree (Mende et al., 2013). Regarding knowledge of environmental consequences, the analysis was completed utilizing a five-point Likert-type scale ranging from strongly disagree to strongly agree (Adapted from Pérez, et al., 2022; Joanes et al., 2020). To analyze if consumers' purchasing behavior is affected by self-esteem, the three questions that were created involve the Likert-type record scale of strongly disagree, somewhat disagree, neutral, somewhat agree, and

strongly disagree (Meuter, 2005; White, 2012). Lastly, we had a few demographics that were multiple choice questions regarding gender, education, year in school, marital status, and income. These questions ranged from a Likert-type four-point scale to a six-point scale (Joanes et al., 2020; Borusiak, 2021; Dono, 2021).

There were 13 survey questions, 5 in matrix style. These questions were coded on an online survey. Survey links were sent to potential samples via social media messages and emails. This survey was a self-administered survey where participants worked at their own pace. This survey took less than 10 minutes to fill out. Participants filled out this survey completely voluntarily, as well as signed a consent form before starting the survey and reaching the initial filter question. Respondents answered these questions through an online survey. We analyzed our outcome variable, purchase intention by using a five-point scale. The five-point scale ranged from strongly disagree to strongly agree (Joanes et al., 2020; Borusiak, 2021; Dono, 2021).

Table 1: Purchase Intention Variables and Scale Reliability

Context	Items on Scale	Reference
Purchase Intention	1. I am confident that if I want, I can reduce my clothing consumption when buying from fashion stores in the future 2. To what extent would you like to reduce the amount of clothes that you purchase 3. In the next three months, when buying clothing items, I would... Refrain from buying clothes about which I have environmental concerns. 4. Please indicate how important the following goals are to you in relation to your clothing consumption. – To reduce my clothing consumption	(Joanes et al., 2020), (Borusiak, 2021), (Dono, 2021)
Knowledge	1. I believe that I am informed about the environmental issues that affect the fashion apparel industry 2. The environmental issues that affect the	(Adapted from Pérez, et al., 2022) & (Joanes et al., 2020)

	fashion apparel industry are very familiar to me 3. Clothing production uses vast amounts of hazardous chemicals 4. Through my personal clothing consumption, I am contributing to the harm done to the environment 5. Through my personal clothing consumption, I am contributing to the harm done to the environment	
Social Media Influence	1. I use social media to improve my relationships with different brands. 2. I use social media to follow events and promotions. 3. My relationship with fashion purchasing is enhanced by social media. 4. Purchasing fashion goods on Social media enhances your mood. 5. I impulsively buy fashion goods when using social media. 6. There is a positive correlation between negative consumption behaviors in the social media domain.	(Bruner, 2015) & (Pellegrino et al., 2022)
Emotional Attachment	1. It is a comfortable feeling to depend on my fashion belongings. 2. I am comfortable having a close relationship with my fashion belongings. 3. It is easy for me to feel warm and friendly towards garments I already own. 4. It helps to turn to my fashion belongings in times of need.	(Mende et al., 2013)
Self-Esteem	1. The clothes that I wear boost my Confidence and Esteem. 2. Clothing reflects how I feel about myself 3. I feel self-assured when I purchase clothing.	(Meuter, 2005) & (White, 2012)

V. Data Analysis and Results

After completing our data collection process, our team began analyzing the data that was downloaded from Qualtrics. We analyzed this data on SPSS, and after cleaning the data we began performing statistical analysis. Initially, the descriptive statistics we performed were our participants' demographics. Second, descriptive statistics were conducted for each variable: Social Media Influence, Knowledge of Social and Environmental Consequences, Emotional Attachment, and Self-Esteem. We used each of these variables to create a scale composite through the scale reliability analysis. Lastly, we ran a correlation analysis for our hypothesis testing segment with our previous composite scores to analyze our R-Pearson's and significance values to determine whether or not our variable supports our hypothesis and/or rejects our null hypothesis.

Sample Descriptives

Out of a total of 108 collected responses, 21 respondents did not match the filter questions for age demographic, leaving 87 usable responses. This was due to a filter question that asked if a respondent was born between 1997 and 2005 and if they were not, they were unable to answer other questions. Throughout the survey, responses dwindled, leaving only 62 respondents who were able to complete this Qualtrics survey all the way through. Out of the 108 survey respondents, 57.4% were final usable samples that were used in data analysis. In addition to this, 42% of the usable responses were from university seniors, and 68% of the usable responses identified as female.

Participants were asked a range of questions including variables such as purchase intention, knowledge, social media influence, emotional attachment, and self-esteem regarding the intention to reduce overconsumption. For purchase intention, questions from the survey were

excluded, in which respondents answered questions detailing reducing the number of clothing that is purchased, to what extent can a person reduce clothing, and in the future if the participant will purchase less clothing. Respondents were likely to strongly agree or somewhat agree with these questions. For the knowledge variable, participants were asked about their knowledge of the harmful effects clothing can have on the environment. For Social media influence, survey questions asked how respondents used social media to improve their relationships with fashion purchasing, how these relationships are enhanced, as well as how viewing and purchasing clothing shown on social media relates to impulsive purchasing. For emotional attachment, the questions involved asking participants about their feelings of comfortability with clothing and what emotions they felt when purchasing clothing. As for the self-esteem variable, the questions that participants were asked included if purchasing clothing is something that enhances their self-esteem and if it leaves them feeling self-assured. Most participants somewhat agreed with these statements, and very few strongly agreed.

Table 1: Demographic characteristics of the sample

Demographic Variable		Frequency	Percent %
Gender			
Male		18	28.1
Female		42	65.6
Non-Binary		1	1.6
Prefer not to say		1	1.6
	Total	62*	96.9%*
Education			
High School/GED		7	10.9
Some College - No Degree		28	43.8
Associate's Degree		11	17.2
Bachelor's Degree		15	23.4
Graduate/Professional Degree		1	1.6
	Total	62*	96.9%*

School Year			
Freshman		2	3.1
Sophomore		5	7.8
Junior		10	15.6
Senior		22	34.4
Graduate		6	9.4
Other		7	10.9
	Total	52*	81.3%*
Marital Status			
Single		58	90.6
Married		2	3.1
Widowed		1	1.6
	Total	61*	95.3%*
Annual Income			
Less than \$10,000		23	35.9
\$10,000-\$24,999		15	23.4
\$25,000-\$34,999		7	10.9
\$35,000-\$49,999		10	15.6
\$50,000-\$64,999		3	4.7
\$65,000-\$79,999		2	3.1
\$80,000 and above		2	3.1
	Total	62*	96.9%*

*The total percentage is less than 100% due to missing data.

4.2 Scale Reliability and Factor Analysis

The internal consistency of each construct was assessed using R-Pearson and Significance for a maximum acceptable level of $p \leq 0.05$. Variables such as Social Media Influence, Emotional Attachment, and Self-esteem were above the acceptable level of 0.05 because of the high correlation between questions of the variables (see Table 2). The Knowledge of Social and Environmental Consequences variable was below the acceptable level and is supported after the correlation analysis. Even though three out of four variables were deemed insignificant, the questions were not removed, as they have been deemed important by the

researcher. In addition to being from reliable sources, deleting these questions did not improve the scale reliability (α value).

Table 2: Factor Loading

Questions	Mean	Cronbach's Alpha (α)	Factor Loading
Purchase Intention:			0.844
-I am confident that if I want, I can reduce my clothing consumption.	4.09		Excluded
-The younger generation, generally, thinks a high amount of clothing consumption is a good thing.	3.56		Excluded
-Sometimes, I think I should reduce the number of clothing items that I buy.	3.42		
-In the future, I wish to purchase fewer clothing items than I currently do.	3.14		0.909
-To what extent would you like to reduce the amount of clothes that you purchase?	2.91		0.881
			0.837
Knowledge:			0.729
-Clothing production uses vast amounts of hazardous chemicals.	4.12		0.788
-Through my personal clothing consumption, I contribute to the harm done to the environment.	3.42		0.645
-Disposal of used clothing contributes to environmental pollution.	4.24		0.882
-Over the next three months when buying clothing items, I would refrain from buying clothes about which I have environmental concerns.	3.75		0.650
-Through my personal clothing consumption, I can reduce the environmental impact.	3.75		Excluded
Social Media Influence:			0.819
-I use social media to improve my relationships with different fashion brands.	2.98		0.682
-I use social media to follow fashion events and promotions.	3.14		0.724
-My relationship with fashion purchasing is enhanced by social media.	3.31		0.836
-Purchasing fashion goods on social media enhances my mood.	2.89		0.795
-I impulsively buy fashion goods when using social media.	2.41		0.768

Emotional Attachment:		0.769
-It is a comfortable feeling to depend on my fashion belongings.	3.20	0.818
-I am comfortable having a close relationship with my fashion belongings.	2.50	0.810
-It's easy for me to feel warm and friendly toward the garments I already own.	3.88	0.769
-It helps to turn to my fashion belongings in times of need.	3.05	0.700
Self-Esteem:		0.649
-I believe that self-esteem has to do with me feeling confident or unconfident in myself.	4.24	0.601
-Clothing reflects how I feel about myself.	3.89	0.397
-I feel self-assured when I purchase clothing.	3.47	0.629

4.3 Hypothesis Testing

The first correlation analysis was used in testing Variable 1, the intention to reduce overconsumption, and Variable 2, the influence of social media and social media influencers. The results suggest that the relationship between Social Media Influence and the Reduction of Overconsumption was found to be insignificant. The significance of the P-value is cut off at the value of <0.05, and the correlation testing results given were (p=0.099), and (R-Pearson=0.213). This Correlation analysis explains that the null hypothesis is not rejected, and the alternate hypothesis is not supported. H1 was not supported due to the P-value of 0.099 being insignificant, as the cutoff value is <0.05.

A second correlation analysis was used to test Variable 1: Reduce Overconsumption and Variable 2: Knowledge of Social and Environmental Consequences. The results indicate that the relationship between Knowledge of Social and Environmental Consequences and Intention to Reduce Overconsumption was found to be significant. Correlation testing results give us (R-Pearson=0.348) and (p=0.006). p is significant, as the cutoff is less than 0.05. The null hypothesis is rejected and the alternate hypothesis is supported. H2 was supported.

A third correlation analysis was used to test Variable: 1 Reduce Overconsumption and Variable 2: Emotional Attachment on fashion belongings. The results indicate that the relationship between Emotional Attachment and the Intention to Reduce Overconsumption was found to be not significant. The Correlation analysis gives us the results (R-Pearson=0.187) and (p=0.143). P is not significant, as the cutoff is less than 0.05. The null hypothesis is not rejected and the alternate hypothesis is not supported. H3 was not supported.

Lastly, a fourth correlation analysis (H4) Variable 1: Consumers with low self-esteem are negatively related to the intention of overconsumption. Variable 2: Null Hypothesis: Consumers with low self-esteem are not negatively related to the intention of overconsumption. The results indicate that the relationship between self-esteem and an intention to reduce consumption is not significant. Since the P-value is p=0.462, P-value is larger than 0.05. This means that the P value is not significant. When it is not supported this means Null will be not rejected and the alternative is not supported. P=0.462, B=0.96, it is not supported.

Table 3: Results of hypothesis testing

Hypotheses Number	Variable 1	Variable 2	R- Pearson	Sig.	Support
H1	Reduce Overconsumption	Social Media Influence	0.213	0.099	Does not Support
H2	Reduce Overconsumption	Knowledge of Social and Environmental Consequences	0.348	0.006	Supports
H3	Reduce Overconsumption	Emotional Attachment	0.187	.143	Does not Support
H4	Reduce Overconsumption	Self Esteem	0.96	.462	Does not Support

VI. Discussion and Implications of Findings

General Discussion

The study aimed to understand the factors driving overconsumption in the fashion industry, focusing on the role of social media influence, emotional attachment to fashion belongings, knowledge of environmental/social consequences, and self-esteem in consumer purchasing habits. The researchers conducted this survey targeted Generation Z, utilizing a quantitative descriptive design and various measurement scales adapted from previous studies. This inquiry is crucial in light of increasing concerns about the fashion industry's environmental impact and the growing influence of fast fashion (Cameya, 2022).

Contrary to the initial hypothesis, the study results found no significant relationship between following social media influencers who frequently post about new fashion items and the intention to reduce overconsumption (H1). This suggests that the influence of social media on encouraging the reduction of overconsumption in fashion is less than anticipated. These findings challenge the common perception that social media is a major driver of overconsumption in the fashion industry, indicating that other factors might be more influential (Short, 2022). The hypothesis that emotional attachment to fashion belongings would lead to longer-lasting relationships with these items and reduce overconsumption was not supported (H2). This indicates that emotional attachment does not significantly deter overconsumption behaviors, challenging existing theories that posit such attachments might encourage more sustainable consumption behaviors (Ferreira & Neto, 2023). The lack of a significant relationship suggests that emotional attachment to clothing does not necessarily translate into sustainable consumption behaviors, which is an interesting insight into consumer psychology. This study found a significant relationship between the awareness of the social and environmental consequences of

fashion, and the intention to reduce overconsumption (H3). This highlights the importance of increasing consumer awareness about the fashion industry's negative impacts as a potential strategy to curb overconsumption (Pérez, Collado, & Liu, 2022). The significant relationship found underscores the importance of education and awareness in promoting sustainable consumer behaviors. It implies that informed consumers are more likely to make environmentally and socially responsible choices. The research findings did not support the hypothesis that low self-esteem correlates with a higher intention of overconsumption (H4). This suggests that self-esteem may not be a major factor influencing overconsumption in the fashion industry. The absence of a significant relationship between self-esteem and overconsumption suggests that the psychological factors driving overconsumption are complex and may not be directly linked to personal self-worth (Seung-Mcfarland, 2022).

These findings contribute to the ongoing discourse on sustainable consumer behavior in the fashion industry. While past research has often emphasized the impact of social media and emotional factors, this study provides a nuanced understanding, highlighting the paramount importance of consumer education over other factors like social media influence and emotional attachment. Additionally, the insignificant role of self-esteem in driving overconsumption adds a new perspective to the psychological factors underpinning consumer behavior in the context of fashion sustainability.

Implications

Based on our research findings, we suggest businesses spread awareness to educate consumers about overconsumption through educational marketing, social media strategy, retail technology, and more (Cameya, 2022; Carlsbad, 2021). Educational marketing can impact the knowledge consumers have on the social and environmental consequences of fashion as well as

the feeling of emotional attachment. The educational marketing strategy could be used to create consignment stores and recycling programs in which campaigns can be created to teach consumers about the benefits of shopping secondhand and/or recycling and overall influencing environmentally conscious consumers. Social media is another strategy businesses could use to spread awareness of the environmental harm fashion brings to consumers by influencers and/or ads speaking on the issue of overconsumption. The influence of social media could educate the audience on sustainable practices and not solely promote products, this way consumers are more likely to care for the environment through sustainable consumption. As self-esteem was not a significant factor in overconsumption, retailers implementing technology should focus on other aspects like consumer education and awareness.

Retail technology can provide information about the sustainability of products, thus empowering consumers to make informed choices. This technology should be used to enhance the shopping experience by making it more informative. For example, interactive displays could provide information about the environmental footprint of products, aligning with the consumer’s growing interest in sustainable practices. Retailers can use technology to create forums or platforms for customers to discuss and learn about sustainable fashion practices, which aligns with the finding that awareness and knowledge play a crucial role in consumer behavior (Meuter et. al 2005).

Future strategies should focus primarily on consumer education about the environmental and social impacts of overconsumption. Strategies could include in-store workshops, online webinars, collaboration with environmental groups, and the promotion of sustainable products and practices. This includes highlighting the longevity, quality, and ethical production methods of products to align with the consumer's growing environmental consciousness. Creating a

community of conscious consumers through social media, events, and in-store experiences can create a loyal customer base and spread awareness about sustainable practices. By applying these strategies, businesses can not only address the issue of overconsumption in the fashion industry but also align their practices with evolving consumer preferences toward sustainability and ethical consumption (Carlsbad, 2021).

Limitations

Initially, the Qualtrics survey collected 108 responses, but only 62 were usable for analysis, leaving 57.4% of initial respondents who completed the survey. This reduction in sample size may have limited the generalizability of the findings. In addition, the survey included a filter question that restricted responses to those born between 1997 and 2005 (Gen Z). This narrow age range limited the study's applicability to a broader population. Of these usable responses, 68% identified as female, which skewed the gender representation which could affect this study's applicability to all genders. A significant portion (42%) of the usable responses came from university seniors. This concentration on a specific educational level may not reflect the broader population's perspectives and behaviors (Liu, 2021). These limitations highlight the need for caution in generalizing the study's findings to a wider population. Future research could address these limitations by expanding the age range of participants, ensuring a more balanced gender representation, and including a more diverse educational background to enhance the study's external validity.

Future Suggestions

Future studies should include a wider age range beyond those born between 1997 and 2005. Incorporating a more diverse demographic in terms of age, gender, education level, and cultural background, would provide a more comprehensive understanding of consumer behavior

across different segments of the population. To enhance the reliability and generalizability of the results, future research should aim for a larger sample size, as this would allow for more robust statistical analysis and the ability to detect smaller effects that may be significant. In addition, incorporating qualitative methods such as interviews or focus groups could offer deeper insights into the motivations and attitudes of consumers regarding fashion consumption. This could complement the quantitative data and provide a more nuanced understanding of consumer behavior. Future research could benefit from experimental designs such as these to test specific interventions or educational programs aimed at reducing overconsumption. This could help identify effective strategies for promoting sustainable consumption behaviors. Given that self-esteem was not found to be a significant factor, exploring other psychological aspects such as personal values, identity, and lifestyle choices could provide further insights into the drivers of overconsumption. Investigating the role of different social media platforms and influencer types in shaping consumer behavior could provide more detailed insights (Lloyd et al., 2022). This would help understand if certain platforms or influencer profiles have more influence on consumer purchasing decisions. By addressing these aspects, future research can deepen the understanding of consumer behavior in the fashion industry, particularly regarding overconsumption, and contribute to the development of more effective strategies for promoting sustainable consumption.

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Corona Ximena Investigating Extracellular Degranulation and Optimizing Degranulation Deficiency in Neutrophil-Like Cells

Abstract:

More than 3 million Americans every year are infected by the protozoan parasite *Trichomonas vaginalis*. Cases worldwide have reached over 400 million, making it the most common non-viral sexually transmitted infection. Trichomoniasis, although largely asymptomatic, may be coupled with painful urination, “frothy” vaginal discharge, and pelvic discomfort. More concerning, trichomoniasis infections are associated with several reproductive complications, such as pre-term labor and have been correlated with HPV16 positive patients’ increased progression of cervical neoplasia. However, this widespread infection remains classified as a neglected disease. We aim to study the way neutrophils mount a response against the parasite, beginning at the site of infection, where they use an array of defense mechanisms to control the invading parasite. Neutrophil degranulation is characterized as the process through which toxic granules are mobilized for pathogen killing. The microbicidal contents of the granule are released extracellularly landing on the target surface. The characterization of the interplay between neutrophil degranulation and trogocytosis remains poorly understood. We hypothesize that degranulation serves to degrade the surface of the Trichomonad parasite, helping facilitate trogocytosis, a novel mechanism employed by neutrophils. The protein STXBP2 plays several roles in the subcellular events necessary for degranulation to occur, but the mechanistic steps remain poorly understood. It is proposed that STXBP2 chaperones and docks neutrophil toxic granules intracellularly, allowing the granules to fuse with the plasma membrane. We therefore also hypothesize the gene *STXBP2* plays a critical role in degranulation, and third, we hypothesize that neutrophil-like cells (NLCs) will have a reduced ability to kill *Trichomonas vaginalis* if they cannot degranulate. To test our first hypothesis, we

attempted to knock out *STXBP2* using CRISPR/Cas 9. We found that our resultant knock-out mutant NLCs still had STXBP2 protein despite having impaired degranulation function. We then screened 6 different crRNAs on new HL-60 cells and found a candidate which we will test degranulation function on. In the future, we will use knock-out mutants and co-culture them with *Tv* in a cytolysis assay followed by a trogocytic assay, which may determine if degranulation- deficient NLCs are still able to kill the parasite via trogocytosis.

Introduction:

The human immune system, although intricate, has consistent players when it addresses pathogens¹. Accounting for 50-70% of all leukocytes in our bloodstream, neutrophils are recruited first to the infection site and they have an array of methods to deal with many invaders¹. The neutrophil defense mechanisms are well characterized and known as degranulation, NETosis, and phagocytosis¹. In 2018, Matlung et al. found that neutrophil antibody-dependent cellular cytotoxicity against breast cancer cells was mediated through a novel technique called trogocytosis, the act of taking bites from neighboring cells². The mechanisms through which trogocytosis is carried out are still in the process of being established. However, in 2018 Mercer et al. was able to demonstrate for the first time, neutrophils using trogocytosis to kill the parasite *Trichomonas vaginalis* (*Tv*)³. We aim to investigate the way neutrophil-like cells utilize trogocytosis as a defense mechanism against *Tv* and explore the relationship between extracellular degranulation and trogocytosis.

Tv is a large protozoan parasite with multiple flagella, causing the sexually transmitted infection (STI) called trichomoniasis. It is between 7-10µm making it roughly the same size as a neutrophil¹. Every year, more than 3 million Americans are infected by *Tv*, with cases worldwide reaching over 400 million, making trichomoniasis the most common non-viral STI⁴. Trichomoniasis may be coupled with painful urination, “frothy” vaginal discharge, and pelvic pain⁴. Several reproductive complications are associated with trichomoniasis including premature labor, endometriosis, and infertility⁴. In patients who were HPV16 positive, a trichomoniasis co-infection was found to be associated with the abnormal growth of cells in the cervix⁵. However, trichomoniasis is largely asymptomatic, with little understood of the burden

and impact of the infection in asymptomatic individuals⁴. Trichomoniasis is not a reportable disease and other factors, like its high prevalence, classifies it as a neglected parasitic infection according to the Center for Disease Control and Infection. Treatment for a trichomoniasis infection includes antibiotics such as metronidazole, however, antibiotic resistance is on the rise, therefore it’s imperative to understand the host-pathogen interactions that occur⁴.

We aim to study how neutrophils mount a response against *Tv*, which begins at the site of infection, where neutrophils rapidly swarm the parasite. Neutrophils then begin to degrade and trogocytose the parasite’s plasma membrane⁵. However, the interplay between neutrophil degranulation and trogocytosis is yet unknown. Degranulation is a process that mobilizes toxic granules for extracellular release. The granules contain serine proteases and other microbicidal products which land on the surface of the parasite, degrading the plasma membrane⁵. Neutrophils secrete four granules known as Primary, Secondary, Tertiary, and Secretory. They are made in sequential order and are released in reverse beginning with secretor⁵. Each granule type is comprised of its own set of microbicides which specify their function⁵.

A key player in degranulation is Syntaxin-Binding Protein 2 (STXBP2) which chaperones the toxic granules to the inner leaflet of the plasma membrane⁷. There STXBP2 crosslinks trans-membrane proteins along the membrane with proteins located on the surface of the granule vesicle ^{[7][8]}. By binding the receptors, STXBP2 forms the SNARE-complex (Fig. 1)⁸. The SNARE-complex initiates the fusion mechanisms through which the granules, bound by STXBP2, fuse with the plasma membrane of the neutrophil, resulting in release of the granule contents extracellularly (Fig.1) ^{[8][7]}. The consequences of a disruption in *STXBP2* can be seen in the blood of patients with familial hemophagocytic lymphohistiocytosis (FHL-5)⁹. A hallmark of this

disease is a point mutation in *STXBP2*, and as a result the patient has granulocytes without cytotoxicity function⁹. We therefore hypothesize the gene *STXBP2* plays a critical role in a neutrophil's ability to release its toxic granules, and secondly, we hypothesize that the neutrophil will have a reduced ability to trogocytose and kill *Tv* if it is incapable of degranulating. The characterization of the interplay between neutrophil degranulation and trogocytosis leading to the subsequent killing of *Tv*, will shed context on an unexplored facet of the immune response against this neglected parasitic infection.

Using neutrophils isolated from human blood for these experiments is not feasible, due to neutrophils' short life span of 1 day after isolation¹⁰. Differentiating neutrophil-like cells (NLCs) in-vitro from the promyelocytic leukemia cell

line, HL-60, provides a reliable model to study degranulation¹¹. Additionally, the HL-60 cell line is further down the differentiation pathway, making the process less exhaustive than if neutrophils were differentiated from the hematopoietic stem cell¹¹. Here, we attempted to generated NLCs that are degranulation deficient by using the CRISPR-Cas9 system to knockout the *STXBP2* gene.

We electroporated HL-60 cells with a ribonucleoprotein (RNP) complex and HDR oligonucleotides. During CRISPR/Cas9 editing, the crRNA guides the Cas-9 to the locus of

interest, where the Cas-9 then makes a double-stranded break in the DNA. crRNA #1 was designed to target a region upstream of *STXBP2* using that site's complementary bases. We added HDR oligos encoding for a stop and silent mutation to the RNP complex to direct the cell for repair. We then stimulated the edited clones for degranulation to observe whether they had impaired degranulation function.

To confirm that the degranulation deficient NLCs did not produce *STXBP2*, we sought to detect the presence of *STXBP2* by way of intracellular antibody staining. We found that degranulation – deficient NLCs still had *STXBP2* protein. Knock-out mutants should not have any levels of detectable *STXBP2* proteins, therefore, we edited new cells and screened six crRNAs to determine if any showed lower levels of *STXBP2*. We found the six crRNAs demonstrated varying and inconsistent levels of *STXBP2*. For our knockout and silent mutants, previous lab mates had used crRNA #1 to edit HL-60 cells based on preliminary data showing crRNA #1 had the most reduction in degranulation in the NLCs. Our α -*STXBP2* stainings, however, show that crRNA #1 has the highest mean fluorescence intensity (MFI). We also found that crRNA #6 had the lowest MFI across most replicates, therefore, we will transfect this crRNA into new HL-60 cells to proceed with screening for degranulation function ability. Our data suggests that there may not be an inverse relationship between *STXBP2* expression and degranulation function, which aligns with the findings found by Spessott et al⁷. Their data indicated that *STXBP2*^{R56Q} mutant neutrophils had impaired degranulation, however, the protein expression, by way of western blot, showed *STXBP2* protein expressed similarly to that of WT neutrophils⁷. In the future we aim to electroporate crRNA #6 into new HL-60 cells, and quickly afterwards, screen crRNA #6's ability to reduce degranulating ability. To determine if degranulation deficient NLCs

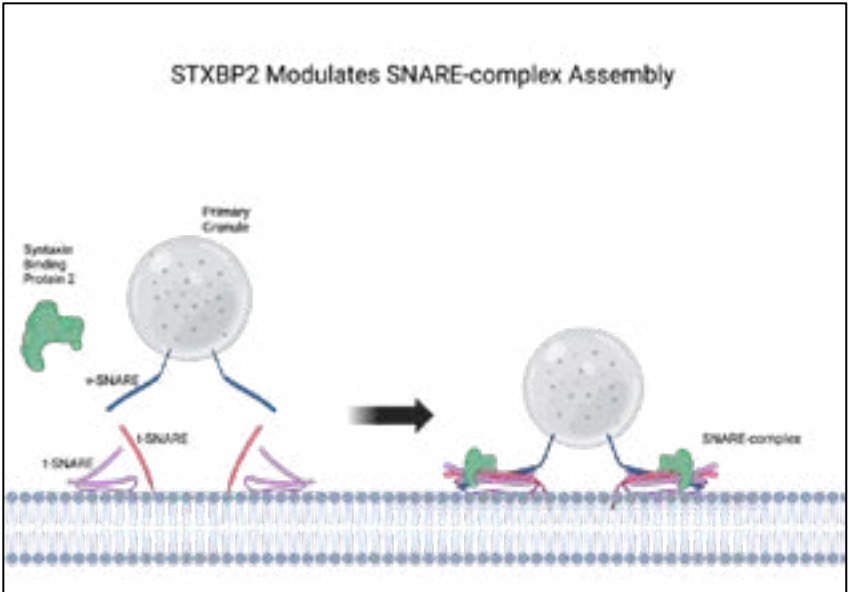


Figure 1: Schematic of how *STXBP2* facilitates the assembly of the SNARE-complex comprised of v-SNAREs and t-SNAREs. *STXBP2* acts as a clasp, resulting in vesicle fusion through the force provided once the SNARE-complex is tightly locked [7][8].

have a reduced ability to kill *Tv* by performing two functional assays. First, a cytolysis assay can determine if the knockout *STXBP2* clones are able to kill the parasite by co-culturing the degranulation deficient NLCs with *Tv*. Secondly, a trogocytosis assay can determine if the deficient NLCs will have a reduced ability to trogocytose *Trichomonas vaginalis*.

Materials & Methods:

CRISPR/Cas9 Transfection:

CRISPR-Cas9 is a ribonucleoprotein (RNP) complex comprised of crRNA #1 and Cas9 enzyme. crRNA #1 was designed to target a region upstream of *STXBP2* using that site’s complementary bases. The RNA complex was formed in a microcentrifuge tube comprised of IDTE buffer, 200 μM tracerRNA, and 200μM crisprRNA. The Cas9 enzyme was added to the RNA complex to form the RNP complex and was incubated at 95°C for 20 minutes. The RNP complex and HDR oligonucleotides were electroporated in R buffer into the HL-60 cells at 1600 volts using the Neon Electroporation system 10 μl at a time. Immediately afterwards, the cells were placed in warm RPMI containing 20% fetal bovine serum and glutamax.

Cell Differentiation:

The resultant mutant clones were differentiated into neutrophil-like cells using 100ng/mL granulocyte colony stimulating factor (G-CSF), 1.3% DMSO, and 10% complete RPMI. The cells were cultured in differentiation media for 7 days and kept at 37C in 5% CO₂ the entire duration.

Clonal Dilution:

Single cell dilutions on transfected HL-60 cells were performed in a 96-well plate. First 100 μl of PBS/plasmocin was added in the wells on the perimeter of where the clones will grow. 10-fold serial dilutions were done in complete RPMI (10% RPMI, 5 mL Glutamax, 6 mL Pen Strep, and 47 mL Fetal bovine serum) such that there was 5 cells/mL in a volume of 5mL. 1 cell per well was then plated by adding 100 μl of diluted sample to grow identical clones. This was done across four plates, and after 16 days, 10 silent clones grew enough to be expanded onto a 24 well-plate.

Stimulation for Degranulation:

The stop and silent mutant clone cells were treated with 5 μM *N*-formylmethionyl-leucyl-phenylalanine (fMLP) and 10 μM cytochalasin b, followed by a 15-minute incubation at 37°C in 5% CO₂. The control population was treated with equal volumes of complete RPMI. To test whether extracellular degranulation was successful, staining with antibodies that bind to the primary granule’s surface protein, CD63, was performed. The cells were fixed with 4% paraformaldehyde after stimulation and stained with 1μg/mL of FITC anti-human CD63 for 30 minutes at 4°C.

DNA Isolation:

To confirm that the knockout mutant clones we observed with impaired degranulation function had the appropriate stop mutation, we attempted to sequence to *STXBP2* locus where the mutations had been targeted. The DNA templates were isolated by first spinning the cells at 300G for 5 minutes. The cells were then lysed with 50mM NaOH in a microcentrifuge tube and heated at 95°C for 20 minutes on a heat block, with rotations to remove condensation at the

ten-minute mark. The contents were then neutralized by adding 10 µl 1M Tris HCl and spun down. The supernatant containing their DNA was collected.

High quality DNA was isolated by using Quick-DNA™ Miniprep Plus Kit. First, 200µl of cells were added to a microcentrifuge tube along with 200µl of Biofluid Buffer, and 20 µl of 20mg/ml Proteinase K. The microcentrifuge tube was incubated at 55C for 10 minutes. We added 1 volume of genomic binding buffer to the digested sample and transferred this to a Zymo-Spin™ IIC-XLR Column in a collection tube. The sample was centrifuged at 12,000g for one minute. The flow through was discarded and, in a new collection tube, 400 µl of DNA Pre-Wash Buffer was added to the spin tube. The sample was centrifuged at 12,000g for one minute, and followed by a wash with 700 µl of g-DNA Wash Buffer. After centrifugation, 200 µl of g-DNA Wash Buffer was added and the sample was spun at 12,000g for one minute. The flow through was discarded. The spin column was transferred to a clean microcentrifuge tube and 50 µl of DNA elution buffer was added directly on the matrix. The tube was incubated for 5 minutes at room temperature, and was then spun at 21,000g for 1 minute to elute the DNA.

PCR and Gel Electrophoresis:

To sequence the DNA, we attempted to produce amplicons surrounding the mutation site. Three different primers were designed. Primer A [FWD: 5'CATCTGTGAGCGTGTCGTCG3' REV:5'ATTTTGTT CTGT TCTGGCACCG3'], Primer E [FWD: 5'CACACTCTACCCGTCCCCT3' REV: 5'CATCTGTG AGCGTGTCGTCG3'], and LTP Primer [FWD:5'CACTGGGATGGGTCA GTCT3' REV: 5'GAGAG CAGGGGCGTCCA3']. The primers were diluted to be at 50uM with nuclease free water. 23 µl nuclease free water, 0.5 µl forward primer, 0.5 µl reverse primer, 25 µl Hot Start Taq polymerase, 5% DMSO and 1 µl DNA template was added to a PCR tube. Once the reagents

were mixed, the PCR tubes were loaded into the thermocycler machine under multiple conditions. Different annealing temperatures were tested ranging from 50°C to 60°C, in addition to increasing cycling parameters from 40x to 60x. The PCR product was loaded onto a 1% agarose gel made with 1x TAE buffer. The gel ran for 20 minutes at 100V and visualized using UV light.

Detecting the presence of STXBP2 protein:

To confirm the presence or absence of STXBP2 protein an intracellular secondary antibody staining was performed. First, 200 µl of cells were fixed in a 96-well plate using 1x Cytofix™. The cell membranes were permeated using a 1x BD Perm/Wash™. 1µg/mL of α-STXBP2 primary antibody or the Rabbit IgG isotype control was introduced to the respective wells and were incubated for 30 minutes at 4°C. After washing twice with 1x BD Perm/Wash™, centrifugation at 300g for 5 minutes, and decanting, we added 1µg/ml of Goat α-Rabbit IgG secondary antibody conjugated with a FITC green fluorochrome to all the wells and cell populations. After a 30-minute incubation at 4°C the cells were washed twice with 1x BD Perm/Wash™ Buffer, spun, and decanted. Lastly, FACS buffer was added before analyzing on the MAQSQuant® Analyzer 10 flow cytometer.

Results:

Producing transfectant HL-60 cells with *STXBP2* mutation

Human neutrophils have a shortened life span, therefore, to carry out experiments we utilized the neutrophil-like cell (NLCs) model differentiated from the promyelocytic HL-60 cell line. To generate NLCs without the ability to degranulate, we attempted to knock out the gene *STXBP2*

using CRISPR-Cas9. Once at the target site, the Cas-9 nuclease should have acted as molecular scissors, and made double-stranded breaks in the DNA, guided by crRNA #1. The cells should have been directed to repair aided by the homology arms flanking the insertion sequence containing either two stop codons or two silent codons. Silently mutated cells are the control population, and stop mutations are the experimental population. We performed clonal dilutions of silently edited HL-60 cells to ensure cell populations with identical mutations for functional assays. We completed serial dilutions to plate 1 cell per well across four plates. After 16 days, there were 10 silent clones that grew enough to expand.

Edited NLCs Show Impaired Degranulation Function

To determine if the stop clones exhibited reduced degranulation ability, we differentiated the clones into NLCs and induced degranulation. Extracellular degranulation can be observed through an increased detection of CD63, a marker on the surface of primary granules and the last granule released during neutrophil degranulation⁵. As the granule fuses with the NLCs plasma membrane to release its cytotoxic contents, it localizes CD63 to surface of the NLCs^{[2][5]}. Of the 10 silent cell clone populations, we concluded that 7 clones retained their degranulation function because they showed an increased detection of CD63 (Fig. 2A). In 6 stop mutant clones we observed impaired degranulation, as they showed CD63 levels comparable to that of the unstimulated cell population (Fig. 2B). To further confirm the impaired degranulation was the result of the *STXBP2* mutation, we then attempted to amplify the *STXBP2* locus through PCR to send for DNA sequencing.

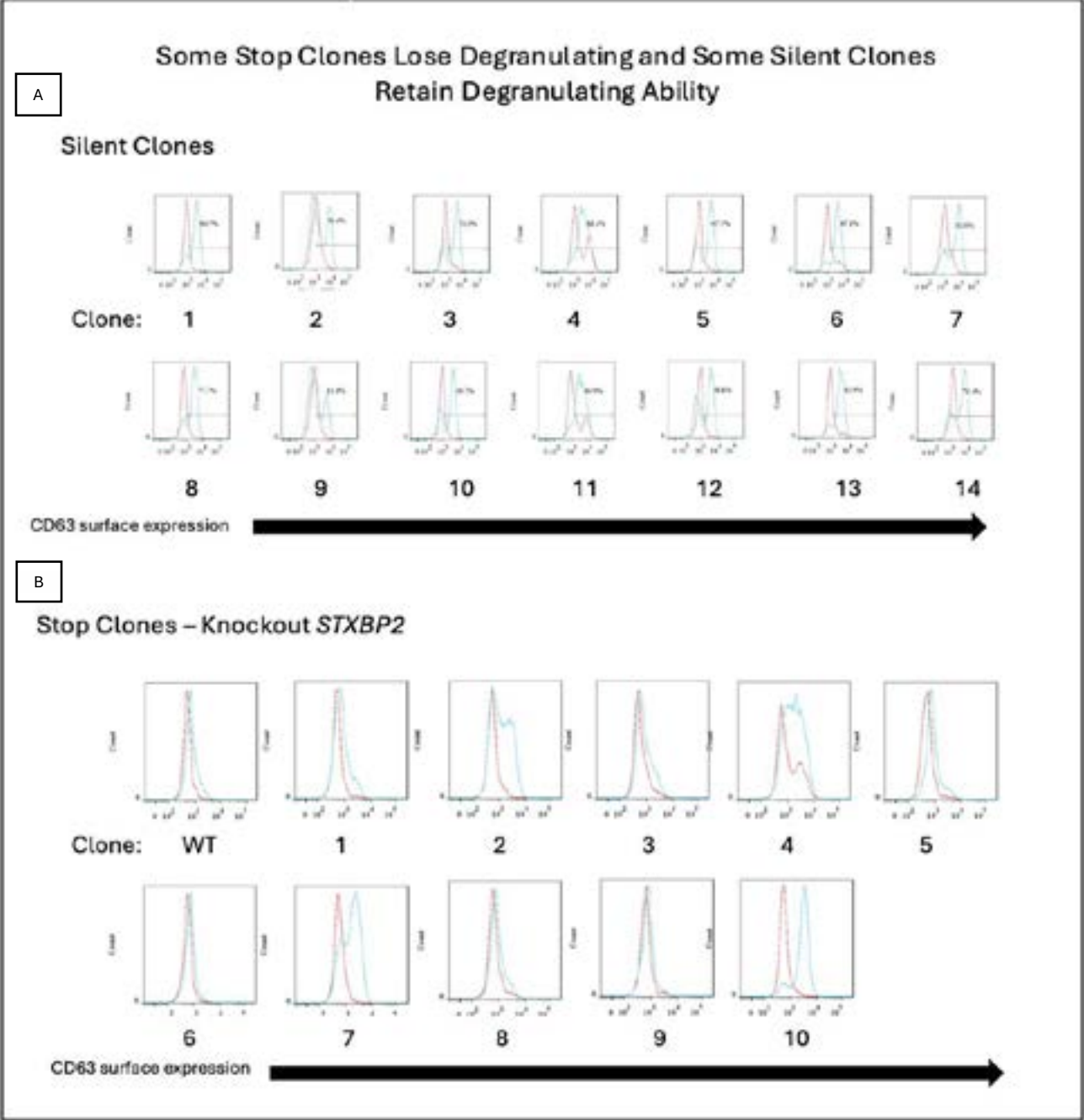


Figure 2: We stimulated NLC mutant clones for degranulation using cytochalasin B and fMLP in triplicates, testing 3 silent clones, 3 stop clones, and a wild type per staining. Some knockout *STXBP2* clones show impaired degranulation function as their levels of CD63 expression are similar to the unstimulated cell populations. The silent clones show levels of increased CD63, consistent with their mutation, as they can still degranulate and the CD63 on the surface of their primary granules as localized to the NLC surface upon exocytosis.

STXBP2 Locus is Not Amenable to PCR Amplification

We attempted to amplify the mutation site at which the cells were edited in the *STXBP2* genome, using PCR. Perhaps due to the mutation site being in a position with difficult primer binding capabilities, this was unsuccessful. We modified several conditions to run the PCR. We tested two sets of primers to target a region of 0.5 kb, with neither producing bands at 0.5kb on a 1% agarose gel. We combined the two, named Primer E, resulting in higher specificity and we tested it on DNA isolated from a Jurkat cell line to rule out the possibility of point mutations within the *STXBP2* locus in our edited HL-60 cells (Fig 3A). However, we again were unable to amplify the target site in the Jurkat cell DNA with this primer (Fig 3A). We then designed primers to amplify an increased length of 1.5kb surrounding the mutation sites, with the goal of moving upstream of a potentially problematic site, and tried using 5% and 10% DMSO to amplify the signal (Figure 3B). The DMSO concentrations had a positive effect on the amount of product

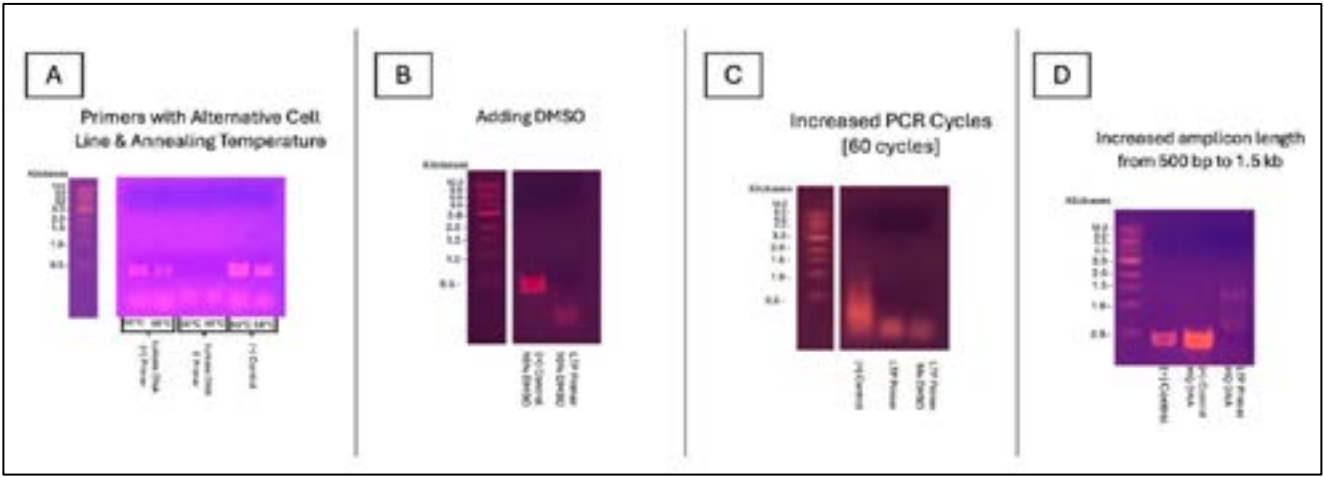


Figure 3. Attempts were made to amplify the mutation site at which the cells were targeted with either the stop or silent mutations, using a polymerase chain reaction (PCR), followed by a 1% agarose gel electrophoresis. Several conditions were modified to run the PCR under. [A] We tested the Jurkat cell line using Primer E at two separate annealing temperatures. [B] We added Dimethyl Sulfoxide to aid amplification at concentrations of 5% and 10% resulting in the brightening of the PCR bands. [C] We increased the amount of PCR cycles which denature, anneal, and extends the DNA from 40 to 60 cycles. This resulted in heavy smearing of our reliable (+) control. [D] The PCR amplicon length was increased from 500 bp to 1.5 kb. A faint band was produced with high quality DNA, and the PCR product was purified out of the agarose gel and sent to be sequenced. However, the sequencing results determined that we had not amplified the *STXBP2* mutation site.

amplified at 500bp in our positive control sample, however the long template primer (LTP) still failed to produce a band (Fig 5B). We then used the *Quick-DNA*TM Miniprep Plus kit to obtain high quality DNA, hypothesizing that higher quality DNA template may aid the primers in binding to this difficult-to-amplify region. The HQ DNA with our positive control primers had an intensified PCR band compared to the DNA isolated using our standard protocol (Fig. 3D). Using 5% DMSO, HQ DNA, and the LTP primer, a band at 1.5 kb was produced. We extracted the band out of the agarose gel to be sent for sequencing, however the sequencing results showed complete misalignment between the PCR product and the known *STXBP2* genome. We determined that we did not amplify the *STXBP2* mutation site.

STXBP2 Detection via Intracellular Antibody Staining

We instead sought to detect the presence or absence of the *STXBP2* protein through an intracellular antibody staining. There were no primary antibodies against *STXBP2* protein conjugated to a fluorochrome available on the market, instead we performed an intracellular secondary antibody stain. We used BD Bioscience's CytoFixTM/CytoPermTM to first fix and permeabilize our cell populations. We introduced the α -*STXBP2* antibody to our samples, which was meant to bind to the *STXBP2* epitope. We added the secondary antibody labeled with a conjugated green (FITC) fluorochrome to bind to the Fc region of the primary antibody. We introduced our control population to an isotype control, followed by the labeled secondary antibody. The samples were run through a MACSQuant[®] 10 flow cytometer and analyzed with FlowJoTM. Upon cytometric analysis of the stains, we found all stop mutant clones showed substantially increased levels of FITC compared to the isotype control indicating the presence of

STXBP2 protein (Fig 4). The silent clones showed levels of bound STXBP2 higher than that of the isotype control, consistent with their silent mutation (Fig 4).

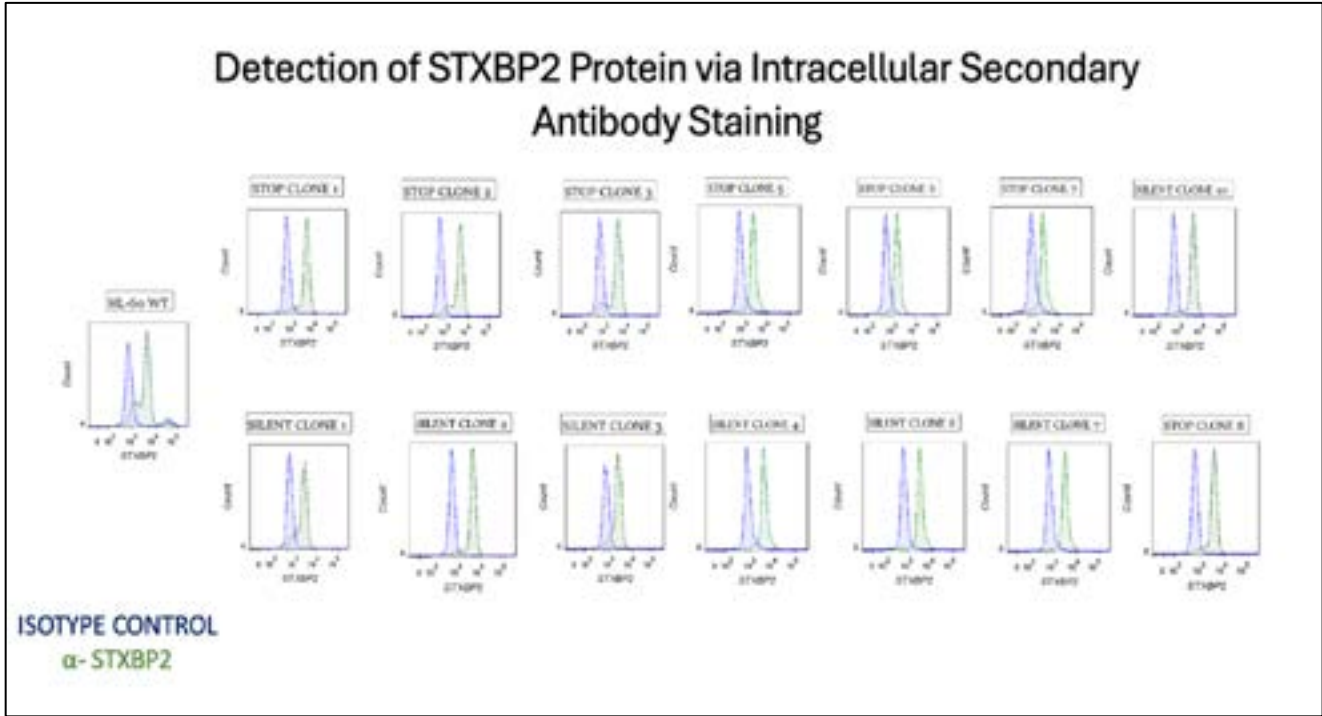


Figure 4. Intracellular secondary antibody stainings were performed using 1ug/ml of Rabbit α -STXBP2 or Rabbit IgG Isotype control. Cells were then introduced to Goat α -Rabbit IgG secondary antibody conjugated with a green fluorochrome. All clones show increased detected levels of STXBP2 protein.

Screening CRISPR RNAs:

The *STXBP2* mutant clones were all produced by using crRNA # 1, along with tracrRNA, to guide the Cas9 nuclease targeting the *STXBP2* locus. However, we found STXBP2 protein in our knockout mutants, therefore we screened new crRNAs using our optimized antibody staining protocol to determine if other crRNAs have lower levels of STXBP2. We transfected new HL-60 cells with 6 unique CRISPR RNAs (crRNA). We found the cells had levels of STXBP2 higher than the isotype control, the mean fluorescence intensity (MFI) demonstrates that

crRNAs #2-6 exhibited lower levels of STXBP2 compared to the negative control (Fig. 6A). The negative control crRNA targets a mouse genomic locus and will not result in a knockout mutation; therefore, these clones will express average levels of STXBP2 protein. We see the largest reduction in STXBP2 protein levels overall in crRNA #5 and #6 (Fig. 5A), however, inconsistency among replicates and between transfections lead us to investigate the stability of the mutation (Fig. 5B). Inconsistency is not seen in the isotype controls (Fig. 6).

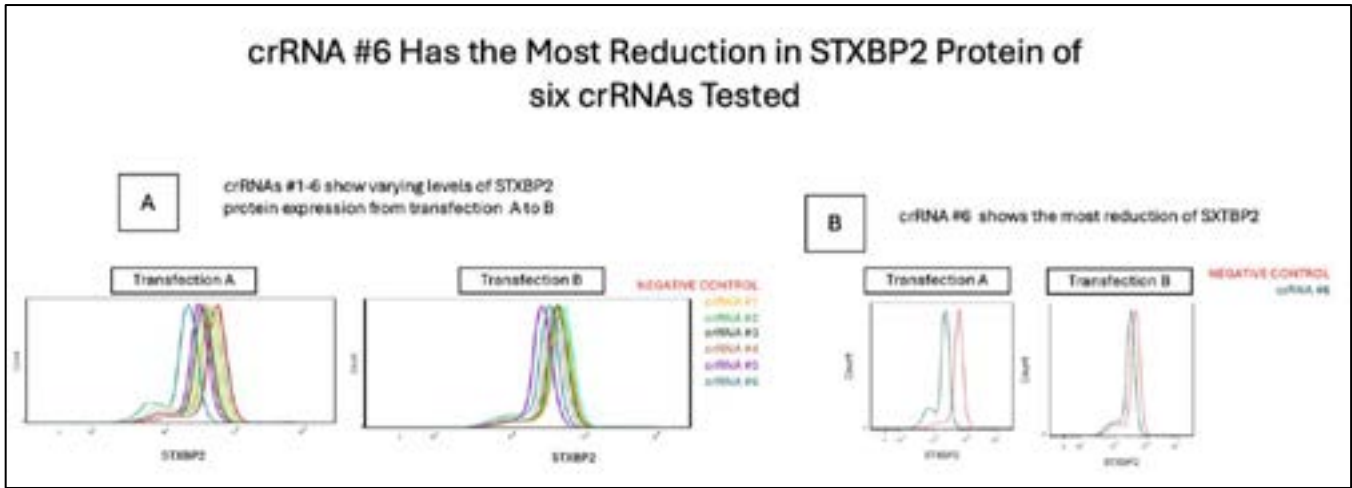


Figure 5: Histogram overlays from Day 7 staining, show most crRNAs in transfection A with levels of STXBP2 protein lower than our negative control. Transfection B depicts variation, with the most prominent example being in crRNA #6. The antibody stainings were performed in duplicates per transfection.

During our first screening, among our replicates, we found slight inconsistency in the fluorescence intensity (Fig. 5B), therefore, we performed another staining on the same cell populations to determine the stability of the *STXBP2* mutation. The second staining was performed seven days afterwards and we found crRNAs #1-6 with MFIs at the same intensity or higher than the negative control on Day 14 (Fig. 6B).

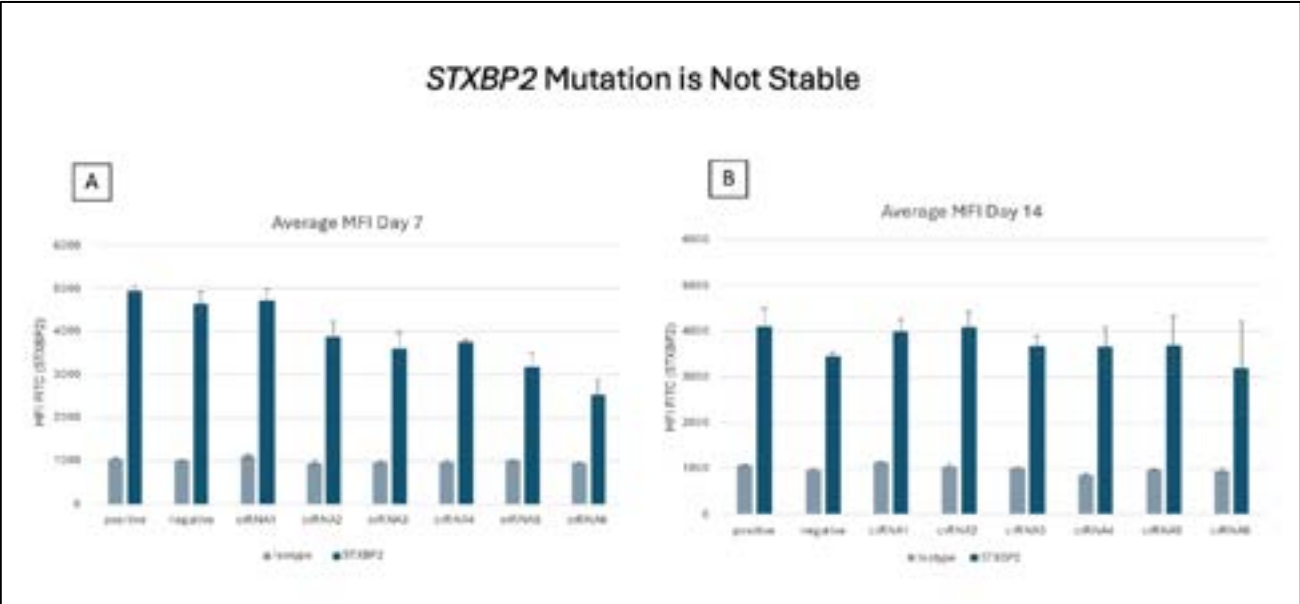


Figure 6: Comparison of mean fluorescence intensity from an intracellular staining of STXBP2 protein performed Day 7 and a staining performed Day 14. Levels of STXBP2 increased in crRNA #1-6, indicating mutation instability amongst the mixed population of cells.

Discussion:

Despite the prevalence of trichomoniasis, the CDC classifies it as a neglected parasitic infection, making it imperative to investigate the events that trigger an immune response⁴. Neutrophils serve as critical first responders in the human immune system and are equipped with a variety of defense mechanisms to combat parasitic invaders¹. One such mechanism is extracellular degranulation, a process that mobilizes toxic granules containing microbicidal contents for parasitic killing¹. We look to the key players involved in degranulation to better understand how it is carried out. Zhao et al. presented data that highlighted Syntaxin-binding protein 2 (STXBP2) as an essential player involved in cytotoxicity⁹. It was found the patients with familial hemophagocytic lymphohistiocytosis (FHL-5) had a monoallelic point mutation in *STXBP2*, and as a result the patient had granulocytes without cytotoxicity function. Neutrophils

from these patients were studied alongside healthy controls evaluating granule release markers upon stimulation⁹. The experiment involved monitoring lactoferrin, elastase, CD66b and CD63 release upon degranulation stimulation⁹. Results showed significantly reduced granule release in FHL-5 patients' neutrophils compared to healthy controls, indicating impaired cytotoxic function⁹. Similarly, a study by Spessott et al. revealed the direct role STXBP2 plays in lytic granule fusion of other granulocytes⁷. They isolated CTLs and NK cells from the blood of an FHL-5 patient with a monoallelic mutation in *STXBP2*⁷. The study examined whether impaired lytic granule mobilization contributes to killing by assessing CD107a expression as a marker for degranulation in NK cells⁷. Compared to control NK cells, they saw significantly reduced surface CD107a expression through diminished mean fluorescence intensity, indicating a cytotoxicity defect associated with impaired lytic granule release due to the *STXBP2* mutation⁷. A 2018 study revealed neutrophils exhibiting trogocytic behavior to manage *Trichomonas vaginalis*³. However, the characterization of the interplay between neutrophil degranulation and the novel microbicidal process, trogocytosis, remains poorly understood. In the present work, we attempted to knock out *STXBP2* in neutrophil-like cells to investigate if degranulation deficiency reduces trogocytic killing of *Trichomonas vaginalis*.

After generating cell populations transfected with knockout *STXBP2* stop mutations or silent mutations, we conducted single cell dilutions to isolate identical clones. Following single cell dilution there were 10 silent clones that grew sufficiently to expand. This resulted in considerably fewer clones than anticipated, suggesting growth interference. We observed this interference in both the knockout clone cells and the silent mutant cells, resulting in 14 stop clones. Previous attempts at performing single cell dilutions with *STXBP2* mutants also resulted

in low clone yields of both stop and silent mutations (Suhani Bhakta, unpublished)¹³. This suggests that disruptions in the *STXBP2* locus may adversely affect cell viability. Upon inducing differentiation of the clonal cell populations into neutrophil-like cells (NLCs), we evaluated their degranulation capabilities. The majority of silent clones exhibited normal degranulation, and a majority of stop mutant clones displayed impaired degranulation. These results align with those presented by Zhao et al., where mutations in *STXBP2* were associated with defects in cytotoxic activity in the granulocytes of patients with familial hemophagocytic lymphohistiocytosis type 5 (FHL-5)⁹. Our data, supported by the previous study, suggest a critical role of *STXBP2* in regulating the degranulation process in neutrophil-like cells. However, to confirm that the degranulation impairment was the direct result of the CRISPR-Cas9, we attempted to sequence the *STXBP2* locus where the mutations had been targeted.

We made several attempts to amplify copies of DNA near the mutation site to be sequenced. After increasing the target amplicon length from 500 bp to 1.5 kb, we observed a faint band on the agarose gel alongside the positive control. However, upon analyzing the sequencing results, we found complete misalignment from the known *STXBP2* genome sequence compared to the PCR product sequenced. The location of *STXBP2* on chromosome 19 may be difficult to access, thus our primers may not be able to bind to their complementary sequence. There are regions of DNA that may be tightly packaged in the chromatin, making that location less accessible for PCR amplification.

We, therefore, opted to confirm the silent and stop mutant *STXBP2* clones by conducting a secondary intracellular antibody staining. Upon analyzing the cytometric results, we found that our silent clones had higher levels of fluorescence than the isotype control, indicating the

presence of STXBP2 protein. However, stop clones also exhibited high levels of detected FITC, despite levels expected to be closer to that of the isotype control. The reason why the stop clones exhibit impaired degranulation function despite having STXBP2 protein remains unclear. This could be attributed to the clones failing to correctly incorporate the stop codons in both copies of the gene during the editing and transfection process. Therefore, to proceed with the functional assays, we decided to generate new knockout NLCs.

The *STXBP2* mutants were transfected with crRNA #1, acting as a guide, directing the Cas-9 to make a cut in the dsDNA. crRNA #1 has a complementary sequence targeting an upstream region in the *STXBP2* locus. The decision to use this crRNA was based on preliminary data indicating crRNA #1 had the most reduction in extracellular degranulation in a previous test (Suhani Bhakta thesis, unpublished¹³). However, six other crRNAs were designed as well, therefore we screened them using our optimized intracellular antibody staining protocol. We found that all crRNAs showed increased levels of STXBP2 protein compared to the isotype control, however, crRNAs #2-6 showed decreased levels of STXBP2 protein compared to the negative crRNA control. Spessott et al. saw levels of STXBP2 protein in *STXBP2*^{R56Q} mutant cytotoxic cells like that of WT cytotoxic cells⁷. They concluded that the monoallelic *STXBP2*^{R56Q} mutation resulted in a negative-dominant interaction, where the *STXBP2*^{R56Q} mutated copy interfered with the WT copy's ability to properly function⁷. Therefore, it is conceivable, that one could detect protein expression, and still see impaired degranulation function. Our mutations may not be acting in this exact way, however, with the characterization of this protein being so poorly understood, this may be an avenue of interest to investigate in the future.

Although the cell populations had levels of STXBP2 higher than the isotype control, the mean fluorescence intensity (MFI) demonstrated that crRNAs #2-6 exhibited lower levels of STXBP2 compared to the negative control. The negative control crRNA targets a mouse genomic locus and will not result in a knockout mutation; therefore, these clones express average levels of STXBP2 protein. We saw the largest reduction in STXBP2 protein levels overall in crRNA #6, however variation of intensity among replicates lead us to investigate the stability of the mutation.

We performed another staining on the same cell populations to determine the stability of the *STXBP2* mutation. The second staining was performed seven days afterwards and showed crRNA clones #1-6 with MFIs at the same intensity or higher than the negative control. We would expect the crRNAs to exhibit lower levels of *STXBP2* mean fluorescence intensity, however, these clones did not undergo single cell dilution. It is therefore likely the mutant cells were out competed by the cells that did not get edited during electroporation. This may also explain why our single cell dilutions yield small amounts of clone colonies, further corroborating the adverse impact of *STXBP2* disruptions on cell viability. It may be necessary to quickly perform single cell dilution and screen crRNA #6 for degranulation function after electroporation.

In summary, our findings offer insights into the complex mechanisms underlying neutrophil-mediated defense and emphasize the critical role of STXBP2 in neutrophil degranulation, but also reveal that *STXBP2* may be a challenging target to knockout. In both the stainings, we found that crRNA #6 had the lowest mean fluorescence intensity, and despite the slight inconsistency among its replicates, we will proceed with crRNA #6 to edit new HL-60 cells.

In the future, we can soon after transfection perform single cell dilution, to stabilize the mutation within a population of identical clones. Should crRNA #6 show impaired degranulation, these degranulation deficient NLCs can be co-cultured with *Trichomonas vaginalis* in functional assays to evaluate the impact on trogocytic killing. A cytolysis assay can be employed to initially determine if the degranulation-deficient NLCs can still kill the parasite. Secondly, a trogocytosis assay can determine if there is a significant reduction in trogocytic killing.

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Diaz Ericka The Effects of an Echinacea Based Ergogenic Supplement on Erythropoietin and Hematological Markers in the Resting Horse

Abstract

In 1989 the term “Nutraceutical” was coined by the blending of two words: “nutrient” and “pharmaceutical”. In both the human and animal world, a “nutrient” is defined as a substance that provides nourishment essential for growth and the maintenance of life, while a “pharmaceutical” is defined as relating to medicinal drugs or a compound manufactured for use as a medicinal drug.

Nutraceutical products are popular in the equine industry for the intent of treatment, control or prevention of various diseases (*e.g.* joints, laminitis). However, the use of nutraceutical as performance enhancer (ergogenic aid) is more commonly used than treatment for a disease. Much of the data used to promote equine nutraceuticals to the public comes from human research. There are a limited number of sound scientific nutraceuticals research studies conducted in the horse providing their efficiency or lack of efficiency. Scientific references on the use of *Echinacea spp* in the equine industry is limited and has been reported to be used for enhancing a healthy immune system and increase hematological parameters. The purpose of the current study was to determine if a commercially available *Echinacea* based equine ergogenic supplement product (EPO-Equine®) would increase circulating plasma erythropoietin, packed cell volume, number of red blood cells, and hemoglobin concentration in the cardiovascular system of the resting horses.

Nutraceuticals and Supplements

The word “Nutraceutical” is often heard in food marketing but has no regulatory definition. In 1989, Stephen DeFelice coined that the term “Nutraceutical” from two words “Nutrition” and “Pharmaceutical” [1]. Nutraceutical has been defined as a food that provides medical or health benefits, including the prevention and/or treatment of a disease [1]. The use of nutraceutical products occurs daily in our lives, dairy products (e.g., milk) and citrus fruits (e.g., orange juice). However, there is a false perception that “all natural medicines are good”, therefore, with all the positive points, nutraceuticals need to have scientific studies done to prove “their effects with reduced side effects” [1]. To get the approval on the nutraceuticals testing must be conducted through Nutraceutical Research and Education Act (NREA) and Nutraceutical Commission (NUCOM).

In 1994, the Dietary Supplement Health Education Act (DSHEA) defined “dietary supplements” in humans as a product taken by mouth that contains a “dietary ingredient” intended to supplement the diet [2]. Supplements which are found in dietary ingredients include vitamins, minerals, herbs, amino acids, and other substances (enzymes and metabolites). Not all supplements used on animals, e.g., dogs, cats, and horses are approved by the Food and Drug Administration (FDA). The FDA requires research conducted on pet food, not supplements, prior to approval and sold to pet owners. A branch of the FDA is the Center for Veterinary Medicine (CVM), which is responsible for regulation of animal food products. The FDA-CVM compliance policy guide section 690.100 specifically addresses the regulation of nutritional supplements for companion animals [2]. There are five rules following this section of the regulation: (1) there is a known need for each nutrient ingredient represented to be in the product, (2) the label represents the product for use only supplementation and not as a substitute for good daily rations, (3) the product provides meaningful but not excessive amount of each of the nutrients that is represented to contain, (4) the labeling should bear no disease prevention

of therapeutic, including growth promotional, representations, and (5) the labeling should not be otherwise false or misleading in any particular [2]. The CVM takes regulatory action against products that violate the policy. The FDA-CVM compliance policy guide does not require scientific applied research in testing supplements which would support the claims of manufactures of the product.

In the United States, horse owners use supplements as treats, or to prevent a perceived issue. For example, 57% of horse owners use joint supplements to treat osteoarthritis and 90% of horse owners administered these supplements to prevent joint disease used on animals, e.g., dogs, cats, and horses [2]. Forty-three percent of horse owners use hoof supplements as a “therapeutic” aid, whereas 83% administered them as a preventative measure [2]. Most of these products are not suggested for supplementation to horses due to product ingredients which has the potential to be harmful or their unable to digest. Fifty-eight percent of horse owners in the United States spend at least \$30 or more per month on horse supplements, with 15% spending over \$90/month [2]. In 2016, sales of pet supplements were estimated at \$580 million, with owners not knowing if these supplements have any effects or be helpful to the animal [2].

Most dietary supplements fed to horses have not been tested for safety or efficiency. Supplements which claim to be derived from ‘natural’ ingredients may contain components that can act as an ergogenic aid in the horse. Herbal based supplements may affect the performance of the horse and could be a prohibited substance in various equine disciplines [3].

Equids are exceptional athletes and are often provided dietary supplements and additives to support (and enhance) not only their high-performance regimens but also their recovery. A major implication of the persuasive advertising accompanying these products indicates that they will improve a horse’s exercise performance capacity [4]. Increase performance and/or work effort may occur because of improving performance parameters, such

as an increase in red blood cells produced with a concomitant increase of hemoglobin which leads to an upturn in oxygen carrying capacity [5].

Ergogenic Aids

Ergogenic is a word to describe an aid that is used to improve an athlete’s performance and comes from the Greek words’ “ergon”, which means work, and “genic”, which means producing. Substances that increase or improve work production are classified as ergogenic aids. This can be done by increasing strength, speed, endurance, and additional aspects of performance in the equine athlete [6]. Ergogenic substances in the equine industry can be used in many ways to improve a horse’s performance. Some examples of processes include decreased energy requirement, lean muscle mass, improve coordination of muscle fibers and increase levels of available stored energy [7].

Performance enhancing drugs are considered ergogenic aids. Administration of a drug to enhance performance is illegal and banned in most equine sport disciplines. An example of a banned performance enhancing supplement is sodium bicarbonate, which is banned by Standardbred and Thoroughbred racing industries [8]. Hematinics, although not considered an ergogenic aid, are substances that increase hemoglobin and red blood cell production in blood. Hematinics contain combinations of iron, copper, zinc, and B vitamins and adequate levels should be provided to the horse through a fortified diet [8].

When a horse is given an ergogenic aid, it affects parameters in the blood including, but not limited to, the following parameters: red blood cell count (RBC), hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration. The functions and normal resting values in horses for these parameters have been reported by others [9,10]. The function of red blood cells is to carry oxygen to the tissues, normal resting in the horse has been reported as $6.9 - 10.7 \times 10^{12}/L$. Hemoglobin, a pigment within red blood cells, is made of four heme groups and each group is bound to a molecule of

iron. Oxygen attaches to the iron; the RBC's leave the lungs and is then circulated around the body of the horse for metabolic processes. Mean corpuscular volume (MCV) is the measurement of the average red blood cell size, with values within the range of 46.7 ± 2.0 fl – 46.8 ± 4.5 fl. Mean corpuscular hemoglobin (MCH), is the measurement of the average amount of hemoglobin within a red blood cell. The average amount has a normal value range of $16.3 \pm .66$ pg – 17.4 ± 1.7 pg. Lastly, mean corpuscular hemoglobin concentration (MCHV) is the measurement of the average hemoglobin in red blood cells relative to average volume, with a normal range of MCHV of $35.1 \pm .84$ g/dl – 37.4 ± 1.8 g/dl. Factors which can alter these parameters include anemia, dehydration, iron deficiency, and liver disease [7]. Low levels of hematological parameters will impair oxygen transport to the tissues and reduces the performance of the horse.

There are many different ergogenic aids which are used in horses in many sport disciplines. Examples of common ergogenic aids are echinacea extract, cobalt, and propriety protected products. Echinacea extract stimulates the horse's immunocompetence and acts as a hematinic agent and has shown to increase hemoglobin and red blood cell production [11]. O'Neill *et al.* found in their study that horses fed an echinacea supplement had an increase in RBC production and MCV, hemoglobin concentration, and PCV. Cobalt is a required mineral element in the horse's diet; however, it can be dangerous and considered an ergogenic aid if administered in excess. In a study using cobalt as a performance enhancing drug conducted by McKeever, *et al.* reported no changes in PCV, blood volume, or performance [12]. Propriety protected products have been investigated as a nutraceutical supplementation in horse. Horses fed a propriety protected product for 12-weeks found an improvement in the blood parameters including elevated RBC, Hb, but did not modify corporal composition [5].

There are ethical considerations that come alongside the use of ergogenic aids. For instance, the use of sodium bicarbonate has created ethical questions when used in horses, primarily the

racine industry. Sodium bicarbonate administration prior to a race or athletic event can provide buffering capacity of the blood and delay the onset of fatigue [6]. According to the International Olympic Committee, physiologic substances taken in abnormal quantities with intentions of increasing performance violates ethics in both the human and equine sport industry [7].

***Echinacea spp* Supplementation**

Several types of *Echinacea spp* are used in dietary supplements including, *Echinacea purpurea*, *Echinacea pallida*, and *Echinacea angustifolia* [13]. This herbal supplement is commonly used to stimulate the immune system across different species of animals. The most common adverse effect from the use of Echinacea in humans is an allergic reaction that can range in severity from skin irritation to anaphylaxis [14]. A study on Echinacea tablets in humans that showed 0.5% of participants experienced trouble breathing. Current evidence suggests allergic reactions to Echinacea are uncommon and no overdoses have been observed. Although, since Echinacea stimulates a healthy immune system, it is believed that individuals with autoimmune disorders can be exacerbated [14].

Echinacea spp herb has been used as a 'cold fighter' and reported to have anti-inflammatory properties [13]. In mice and humans' studies have demonstrated that Echinacea increases phagocytosis, the process of cells engulfing particles, and production of immune cells [13]. In another study, after administration of powdered *Echinacea purpurea* to dairy calves for 28 days, the calves experience higher body temperatures and higher lymphocyte counts, an indication of reduced inflammation in these animals [15].

Scientific references on the use of Echinacea in the equine industry is limited and has been reported to be used for enhancing a healthy immune system [16] and there have been results showing an increase in hematological parameters as well [11]. A study of eight horses fed *Echinacea* for 42-days improved phagocytosis and stimulated immunocompetence [11]. In

this study red blood cells size and concentration, hemoglobin and packed cell volume values increased, suggesting that *Echinacea* may have haematinic properties.

EPO-Equine® is a supplement containing the active ingredient *Echinacea angustifolia* [17]. This product is advertised to improve performance and training in the horse. Increasing production of the hormone erythropoietin is the mechanism behind the claims of this purported increased performance caused by feeding the EPO-Equine® product. Erythropoietin (EPO) is a hormone secreted by the kidneys and plays a major role in controlling the production of red blood cells of the blood. Red blood cells (RBCs) contain hemoglobin, carrier of oxygen, so the amount of oxygen being delivered to the tissues depends on RBC concentration. Erythropoietin increases RBC production, thus increasing hemoglobin levels, in the blood by operating in the bone marrow [18]. If the capacity of oxygen carriers is raised – muscle energy is also raised, with an increase in muscle energy – horses can perform at higher levels, improving performance and training.

Reference ranges of plasma EPO in horses and investigation of this hormone have been reported in varying studies. The mean value of plasma EPO for 104 clinically healthy horses has been reported as 3.6 +/- 2.3 mIU/ml [18]. The authors reported that 98% of the plasma EPO in these horses ranged between 0 and 9 mIU/ml. Another study conducted on plasma EPO in Arabian horses reported that plasma EPO concentration was independent of sex and age [17]. Clinically healthy Arabians 6-12 months old had plasma EPO concentration of 5.30+/-1.76 mUI/mL and Arabians over 24 months had plasma EPO levels of 6.34 +/-3.25 mUI/mL [18].

Recombinant human erythropoietin (rhEPO) was developed to treat nonregenerative anemia in humans. Administration of rhEPO has been used as a performance enhancing drug in the equine sport industry since the early 1990's [19]. Research by Jaussaud et al developed testing on the effects of injected rhEPO and showed that it did not significantly increase

parameters in the blood in horses [18]. This study concluded that their method of blood testing can help anti-doping measures in the future to detect if horses have been treated with rhEPO. The study also indicates that the level of administered rhEPO may have been insufficient to cause an increase in hematological parameters. Another study found that red cell volume did increase after injecting low dose rhEPO to Standardbred horses [20]. The McKeever study found that performance markers of red cell volume and aerobic capacity increased and rhEPO can act as a performance enhancing drug.

The product EPO-Equine® is intended to increase circulating EPO levels in the blood and leads to a higher number of red blood cells. The active ingredient in EPO-Equine®, *Echinacea aungustifolia* has typically been used to stimulate healthy immune systems but one study in horses suggests it may also act as a hematinic agent. If the supplement EPO-Equine has an effect of increasing circulating EPO and hematological parameters this means it qualifies as a performance enhancing drug, which would give competition horses an unfair advantage. Furthermore, if EPO-Equine® does not affect plasma EPO levels and change blood parameters this product is being falsely advertised.

Purpose of Study

The purpose of this study was to determine if a commercially available equine ergogenic supplement product (EPO-Equine®) would increase circulating plasma erythropoietin, packed cell volume, number of red blood cells, and hemoglobin concentration in the cardiovascular system of the resting horses.

Materials and Methods

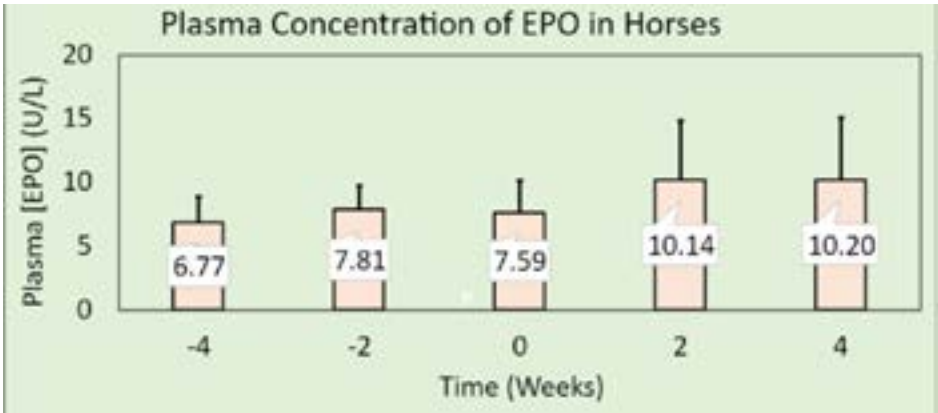
The current study was carried out in accordance with the animal protocol approved by the Institutional Animal Care Use Committee of California State Polytechnic University in Pomona, California (IACUC-2023-0008).

Nine Arabian horses of various age from the W.K. Kellogg Arabian horse center were used in this study. The animals were housed in their normal environment (dry lot), fed alfalfa hay twice a day and water ad libitum. Each day of blood sampling, the horses underwent a basic physical (temperature, pulse, and respiration) to provide data which served as an indicator of the health of the horse. Venous jugular blood samples (6 mls, 22 g x 1” needle) was obtained from the horses during weeks -4 and -2, day 0, and weeks 2-, and 4-of feeding. The samples were transferred into two separate 3mL EDTA vacutainer tubes. Tube 1 was analyzed within 60 minutes for a complete blood count (red blood cell indices) via an IDEXX Hematology System. Tube 2 was spun down via centrifuge and plasma stored at -80°C for analyses of erythropoietin via an ELISA kit (AFG Bioscience #EK753026).

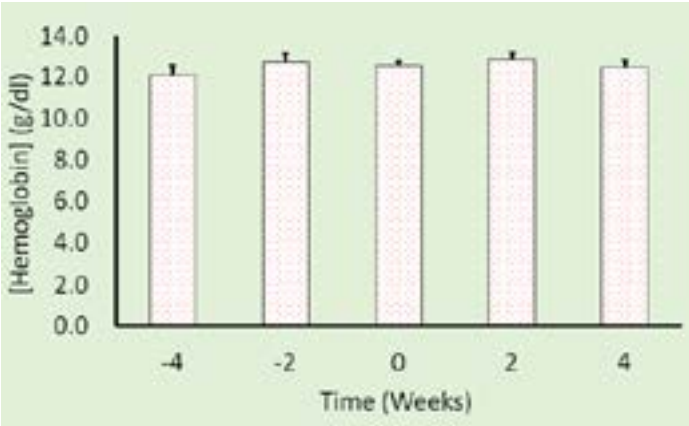
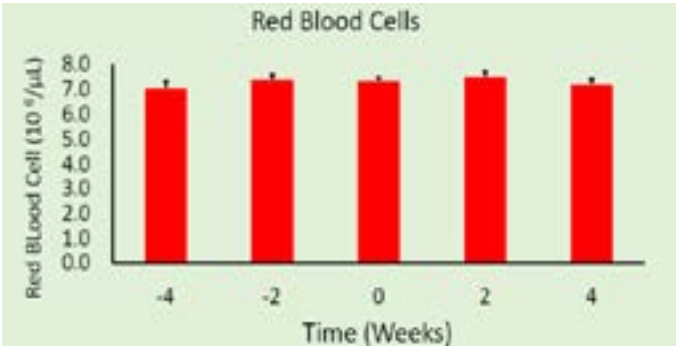
Following manufacturer’s recommended supplement dose, horses were individually fed 6 grams of EPO-Equine®, mixed in 120 grams of grain, and 30 grams of low sugar apple sauce. A standard within the equine feed industry for a supplement to be in full effect is three weeks; therefore, the product was fed for 28-days. The current study feeding length mimics a previously published paper which fed *Echhinacea angustifolia*, the main ingredient in EPO-Equine, for 28 days.

Statistical analyses were assessed using repeated measures of analysis of variances (ANOVA; P=0.05) to identify potential differences between pre- and post-feeding.

Results



Resting plasma erythropoietin in horses before and during a 28-day EPO-Equine® feeding trial. Plasma erythropoietin concentration for all horses were within normal values before the feeding trail began. During the feeding trial period, one of the nine horses had elevated plasma erythropoietin (P < 0.01). Values presented as means ± Standard Deviation (SD).



Resting red blood cells, hematocrit, and hemoglobin concentration in horses before and during a 28-day EPO Equine feeding trail. All values are within reported normal values in horses. No change was evident during the 28-day feeding period. Means ± SD

Parameter	-4 DAY	-2 DAY	Day 0	Week 2	Week 4
MCV (fl)	44.11 ± 1.37	44.19 ± 1.42	44.51 ± 1.44	44.33 ± 1.33	44.58 ± 1.37
MCH (pg)	17.19 ± 0.24	17.22 ± 0.21	17.12 ± 0.24	17.19 ± 0.25	17.33 ± 0.23
MCHC (g/dL)	37.28 ± 0.35	37.16 ± 0.41	36.78 ± 0.30	37.14 ± 0.27	37.17 ± 0.30

Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC) before and during the feeding trial. All values are within previously reported normal values in the resting horse. Means ± SD

Conclusion

Feeding a commercially available equine feed supplement, EPO-Equine®, did not alter the hematological parameters in horses following a 28-day feeding trial. This supplement claims to improve the performance in horses through an increase of erythropoietin, followed by an increase in hematological parameters, mainly red blood cell numbers and hemoglobin. Based on the data collected in the current study, the product EPO-Equine® did not alter the normal resting hematological values of all nine horses fed 2 scoops daily for a duration of 28 days. After analyzation of the blood samples collected, it was concluded that no changes in the hematological parameters (RBC, HGB, HCT, MCV, MCH, and MCHC) occurred and all values remained within normal range.

Erythropoietin concentration was elevated in post-feeding values compared to pre-feeding values in one horse, reflecting a 27.34% increase of following an *Echinacea* based feeding period of 28 days. Removal of this single horse from the study indicates no changes in erythropoietin during the feeding period.

In a study by O’Neill, *et al.* changes in RBC’s and hemoglobin were reported in horses fed 1000 mg of *Echinacea* root twice a day. In the current study, the horses were fed the manufacturers recommended dose of 2 scoops daily, representing 2600 mg of a proprietary ‘Endurance Complex’ product . The ‘Endurance Complex’ includes *Echinacea* and other natural herbs (yellow dock, dandelion extract, lutein extract) and organic compounds (choline bitartrate, inositol). The extract *Echinacea* concentration in the tested product is unknown.

The current study is the first reported controlled objective research study to feed EPO-Equine®, an ergogenic *Echinacea* based feed supplement. Additional research is warranted to determine if this product has any benefits to enhance the performance parameters in exercising horses.

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FINDINGS:

TRANSIT DEVELOPMENT

URBAN IMPROVEMENT

San Francisco, CA:

- The first improvement to travel conditions was made in 1850
- In 1860, the first steam dummy-powered car was made.
- the value of property built alongside lines rose 300%.
- In 1873, the first cable car ascended a hill in downtown.
- In 1891, San Francisco's first electric line went into operation.
- City took over after this point.
- A financial report from 2005 proves that transit in San Francisco is mostly self-sustained off of fares.
- San Francisco transit is available from 5am-12pm



Fayetteville, NC:

- Has one public transit system via bus
- A one-way bus fare is priced at \$1.25. 17% of NC's minimal wage
- Bus hours operate at a max of 5:30am-7:30pm
- 57.8% of Fayetteville K-12 students are economically disadvantaged
- Cumberland County (Fayetteville school district) has an annual revenue of 504M dollars

What are implementable strategies

“What are implementable strategies related to accessible transit, eco-friendly transit, pedestrian-friendly infrastructure urban development, and accessibility to increase walkability in Fayetteville, NC?”

ABSTRACT

Making cities less car-dependent is an integral part of sustainability as they drastically reduce the carbon emissions of a community. According to the environmental protection agency, cars produce the largest amount of carbon emissions compared to anything else in the US, at 29 percent. Walkable cities have also proven to improve health of individuals and boost the economy. With this in mind, our group chose to research ways to create walkable cities in the US by reducing Urban sprawl. This includes research areas such as public transit development, creating public spaces, resource accessibility etc. We decided to chose two cities to research, the most walkable city in the U.S. (San Francisco), and use it to develop ways to reform the least walkable city in the U.S. (Fayetteville)

METHODOLOGY

We divided our research into two key areas: public transit and urban improvement. Each research area was put through three aspects of evaluation: history, impact, and evaluation. Sources were pulled from the CPP library as well as from the web and government databases. Keywords and phrases used in research are as follows: "San Francisco", "Fayetteville", "Public transit", "Urban Improvement", "Public spaces", "Walkability", "Walkable Cities", "Pedestrian infrastructure".

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Dr. Nina Abramzon, Olivia Walsh, and Don B. Dao

DISCUSSION

- Fayetteville has the funds to create a fee waiver system for student transit fare and improve the overall walkability of the city
- San Francisco is one of the most sustainable and walkable cities in the U.S. by focusing a broad amount of funding toward urban improvement such as parks, public transit, and green space.
- Public resources within Fayetteville can improve vastly, with increases in convenience, walkable transit, and lessened road traffic
- Pedestrian infrastructure creates a more equitable and inclusive city, as it benefits people of all ages, abilities, and socioeconomic backgrounds.
- Reduces traffic congestion and air pollution by encouraging walking and cycling, while at the same time improving safety for them.

CONCLUSION

- The existing Fayetteville transit system should start a fee waiver program for students and expand operating hours
- Increasing funds for new public transit can design and more park improvements can increase the sustainability of the least walkable cities of U.S., like Fayetteville.
- Public resources within the city of Fayetteville will be categorized within different sections those being recreation, resources such as public trash cans, buses, bike lanes, emergency services, and required road vehicles.
- Pedestrian-friendly infrastructure is essential for Fayetteville because it will promote walkability, reduce reliance on cars, and enhance public health, ultimately decreasing carbon emissions and fostering a more environmentally and socially responsible urban environment.
- Short-distance transit should be centered in downtown (buses, cable cars, etc).
- Long-distance transit should extend from the city center to outlying suburbs
- Assets should be given to the transit system by the government at the beginning of the year with a fare rate that makes up for assets given.

San Francisco represents an example...

URBAN IMPROVEMENT

- San Francisco is the first and only U.S. city where all residents live within a 10-minute walk to a park, playground, or green space. The proximity of the San Franciscans to green public spaces is essential for public health, clean environments, and sustainable communities. The San Francisco Recreation and Park Department is focusing on maximizing the use of parklands and acquiring new land to develop more parks. This department spent over \$1.1 billion on park improvements.
- San Francisco considering implementing new public trash can designs that are "durable, hard to tamper with, easy to service and aesthetically pleasing". The different public trash cans are called Salt & Pepper, Slim Silhouette, and Soft Square for easy cleaning, service, separating trash and recyclables, and aesthetics.

Improvements

- **Pedestrian-friendly infrastructure** plays a crucial role in enhancing urban livability and sustainability by providing safe and convenient pathways for walking, which promotes public health, reduces traffic congestion, and contributes to a more vibrant and connected community. It also supports environmentally friendly modes of transportation, like walking and cycling, reducing the carbon footprint of a city.
- **Availability** such as grocery stores, and department stores.
- **Public trash cans** would be placed thoroughly throughout the city and coordinated for convenience.
- **Buses and bike lanes** alike will be similar to those in current cities where bikes are able to share the roads with necessary vehicles.
- **Last public resource** is emergency services where these will be the same and be kept with the same prioritization.
- **Emergency services** will still be motor vehicles necessary for urgency.



NATIONAL GEOGRAPHIC MAP DATABASE

CITY AND COUNTY OF SAN FRANCISCO-DAVID RUMSEY HISTORICAL MAP COLLECTION



RESEARCH CITATIONS

It is in this reality, a philosophical reckoning with an unending Civil War where we must understand the history of America is one that has “paid the price of the

On March 18th, 2008, Barack Obama delivered a speech where he stated, “I will never forget that in no other country on Earth is my story even possible.”¹ It is in this moment, a moment preceded and succeeded by an American story historically written in panic and fear, when we were finally allowed to believe in a future with the possibility of transcending our divisions. The Obama movement represents an imperfect coalition built up of ordinary people who had a vision to pursue equality, “a collective action, sustained commitment, and determination to achieve fundamental changes in the social order and in the power relations that sustained it.”² A vision of true democracy, a collective that was never perfect but built a foundation—together—for our moral universe. The Obama presidency represented a time when moral illiteracy was defeated; an arc that showed the good in America, transcended our political divides and brought us together in solidarity. It is in these moments where we are reminded what it means to be American—to be exceptional. These imperfect coalitions represent hope for an unsegregated future, a commitment to the power that derives from the ordinary people who refuse the ticket, and those whose moral passion had an effect of lasting change.

However, if what is truly exceptional about America is we were the first country founded around a constitutional democracy, then we must also acknowledge this very document was written on the core idea that not all men were created equal. We have become a country in which our very foundation has been laid on the backs of slaves. Fredrick Douglas serves as a stark reminder in his calls for constitutional reform. Through examination of the strengths and weakness of the constitution, Douglas reminds us that this document is not divine, “there was neither thundering, nor lightnings, nor earthquakes, nor tempests, nor any other disturbances of nature when this great law was given to the world.”³ We must remember our country is strongest when we are most critical of it. It is not un-American to reject historical amnesia—we are simply loving our country in a James Baldwin sort of way, or more accurately, a Fredrick Douglas kind of way. And it is in this reality where I propose the very struggle between segregation and violence is a result of our own thoughtlessness. The paradigm of our morality is that of a country which has been built off a war we have—and continue—to fight amongst ourselves. The American story is one of the segregations of the mind and soul, a country where our greatest fight—the Civil War—has never ended.

¹ Transcript: Barack Obama's Speech on Race," NPR, March 18, 2008, <https://www.npr.org/templates/story/story.php?storyId=88478467>.

² Thomas C. Holt, *Movement: The African American Struggle for Civil Rights* (Oxford University Press, 2021). Pg. 5

³ John R. McKivigan, Julie Husband, and Heather L. Kaufman, *The Speeches of Frederick Douglass: A Critical Edition* (New Haven: Yale University Press, 2018). Pg. 222

ticket.”⁴ The price has become the reproduction of our own indifference and ignorance, from which racism has been able to become a cancerous tumor infecting the very soul of contemporary civilization. The paradox of our country is reflected in the fact that it is only in America where freedom and slavery can co-exist.⁵ To that end, we must continue to fight against our strongest nationalist tendencies—our national insecurity—and remind ourselves that constitutional amendments are needed, and we the people, means all the people. Not simply just the people whose lives have been historically valued more than others. This is the cyclical nature of political violence. In 1957, just as it is today, voting is and “will always be the moral backstop against a looming disaster.”⁶ This historical tragedy represented a continuation of a logic designed to suppress and the same can be said for today. We have seen a rising wave of political catastrophes; none more threatening than the ultranationalist regime known as the Trump cult. And the way to defeat this threat, this seemingly unending war, is through the right to vote. We, once again, need to build a coalition united around our moral promise; a solidarity that can transcend our differences and overcome American fear and power. It is our generations' time to write our own future, either we become complicit in the destruction of our own movement, or we shape the political world we want to live in.

The answer is a vocabulary and commitment to a social contract forged around radical nonviolence. The radical nonviolence I speak of is represented in the tradition of the Civil Rights movement, the Obama presidency, and the moral universe of voting. Through the building of coalitions, we see the enigma known as America— “an ignorance that is not only colossal but sacred.”⁷ And the premise of our artificial indifferences—racism—which has become endemic in the institutions and ideals of America and is the lie which allows our deep seeded willful ignorance to fester. Our future rests not in the faith that “the moral arc of our universe bends towards justice,”⁸ but through the radicalism of hope. Hope is a difficult political virtue to cultivate because it requires sacrifice, honesty, and a true telling of our past.⁹ This is the political virtue which holds the potential to bring humanity closer to a promised land. Hope is the radical nonviolence needed for moral passion to transcend political divides; the common purpose we must pursue to make the American democratic experiment successful. It is the nonviolence needed to change the world.

⁴ James Baldwin and Randall Kenan, *The Cross of Redemption: Uncollected Writings* (New York: Vintage Books, 2011). Pg.
⁵ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁶ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁷ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993).
⁸ “Martin Luther King, Jr. at Oberlin,” “Remaining Awake Through a Great Revolution,” accessed December 12, 2023, <https://www2.oberlin.edu/external/EOG/BlackHistoryMonth/MLK/CommAddress.html>.
⁹ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023

Foreword: An Epoch of Systematic Inequality and Violence

In Hannah Arendt’s groundbreaking work “Eichmann in Jerusalem,” she makes a critical indictment on not only the hesitation of man to do good, but also understanding the degeneration of the nation-state and the corresponding end of rights of man.¹⁰ The term coined by Arendt— “The Banality of Evil”¹¹—is the perpetuation of evil and the complicity of man when immorality becomes systematic, common, or banal. It is in this interpretation—the inability to think critically—where thoughtlessness, moral illiteracy, and political violence become common place under “the force of law.” Here lies the paradox, though our moral compulsions for sovereignty or security, has humanities temptation to indifference become a function of obedience. As is the case for Eichmann, the intention to “make inequality hurt”¹² has become the cornerstone for the jurisprudence of violence. Legally sanctioned cruelty allows violence to become unchecked and thus indistinguishable under the metamorphosis of the law-abiding citizen. It is in this connection that Arendt reminds of the subservience of the citizen under sovereign rule.

“Evil in the Third Reich had lost the quality by which most people recognize it—the quality of temptation. Many Germans and Nazis, probably an overwhelming majority of them, must have been tempted not to murder, not to rob, not to let their neighbors go off to their doom, not to become accomplices in all these crimes by benefiting from them. But God knows, they had learned to resist temptation.”¹³

Now legalized, Eichmann was allowed to violate with immunity, “drawing its legitimacy from the enchanting powers of the law to create conditions of generalized, voluntary servitude.”¹⁴ In the case of the Nazi—and Eichmann—that Arendt and Kumar make, the temptation to do right was lost, and through immunity these atrocious acts were rendered indifferent. As has sparked much debate, Arendt described Eichmann as “normal.” Not to imply, she excused Eichmann of his crimes. She supported the verdict to end his life. But this observation of normalcy became the foundation for the concept of the banality of evil. How can a “normal” man become complicit—desensitized—to the crimes of mass genocide? This is Arendt’s greatest contribution to post-war intellectual history, that civilization is susceptible to be “slowly and steadily taken over by a nationalistic hubris obsessed with restoration of civilizational purity.”¹⁵ Modern societies greatest flaw, resides in contemporary civilizations quest for majoritarian security which has become far more enticing than humanities love and commitment to nonviolence. This philosophical foundation is essential for a comprehensive understanding of the United States, which has ideologically and morally never ended the civil war.

¹⁰ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
¹¹ Hannah Arendt, *Eichmann in Jerusalem*, 1963. Pg. 24
¹² Aishwary Kumar, “A Jurisprudence of Neglect: Arendt, Ambedkar, and the Logic of Political Cruelty,” *Faith in the World: Post-Secular Readings of Hannah Arendt*, 2021, <https://doi.org/Berlin & Chicago>. Pg. 205
¹³ Hannah Arendt, *Eichmann in Jerusalem*, 1963. Pg. 205
¹⁴ Aishwary Kumar, “A Jurisprudence of Neglect: Arendt, Ambedkar, and the Logic of Political Cruelty,” *Faith in the World: Post-Secular Readings of Hannah Arendt*, 2021, <https://doi.org/Berlin & Chicago>. Pg. 209
¹⁵ Aishwary Kumar, “A Jurisprudence of Neglect: Arendt, Ambedkar, and the Logic of Political Cruelty,” *Faith in the World: Post-Secular Readings of Hannah Arendt*, 2021, <https://doi.org/Berlin & Chicago>. Pg. 228

Illiteracy is not constrained by the nature of time or nation-state borders. In the United States, illiteracy runs rampant upon a society in which thoughtlessness metamorphosed into what is known as Trumpism. Understanding that Trumpism relies on a politic in which “thoughtfulness has never been counted among the political virtues and lies have always been regarded as justifiable tools in political dealings,”¹⁶ is imperative. As Arendt clearly illustrates, lying in politics has always been a deliberate tactic deployed. One might say that politics has been built on distrust. To that end, it seems we are now witnessing a new, more sinister form of distrust with tendrils reaching into all sectors of contemporary civil society. A simple look into the plan titled “Project 2025” shows how the distrust has grown to a delusional level. While racism has been a sincere mechanism throughout American history, we are now seeing a formerly traditional conservative party fallen prey to an obsession with the struggle for power and right to dominate. Where conservatism has limited government, the new Maga movement that is built on lies, represents a delusional quest for centralized governmental power.¹⁷ Hence, this form of delusional governance did not slither into political discourse inadvertently. It is the fragility of the truth and the longing of the populous which permits the equivocate.

“It is this fragility that makes deception so very easy up to a point, and so tempting. It never comes into a conflict with reason, because things could indeed have been as the liar maintains they were. Lies are often much more plausible, more appealing to reason, than reality, since the liar has the great advantage of knowing beforehand what the audience wishes or expects to hear.”¹⁸

However, as Arendt indicates, the lie which has been meticulously crafted will inevitably be destroyed by those brave enough to confront it.

There is no greater bravery than those willing to sacrifice their bodies in the name of civil disobedience. Those who represent the civil rights tradition—a faction that demands the truth, and the rights born to our body based on the premise that our humanity is universal.¹⁹ Thus, a return to a just and moral conscience is needed to confront this corrosive beast. In which, humanity must not only come to terms with “the enormity of the crime,”²⁰ but also recognize that our greatest war—the civil war—has become the root embedded within the bedrock of a logic ruled by cruelty. Our disobedience is justified by a quest to confront and eradicate an epoch of systematic inequality and violence. This commitment to confront cruelty is how, as James Baldwin says, “we can make America what America must become.”²¹

¹⁶ Hannah Arendt, *Crisis of the Republic* (Harmondsworth: Penguin, 1973). Pg. 4
¹⁷ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
¹⁸ Hannah Arendt, *Crisis of the Republic* (Harmondsworth: Penguin, 1973). Pg. 6
¹⁹ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
²⁰ Hannah Arendt, *Crisis of the Republic* (Harmondsworth: Penguin, 1973). Pg 81
²¹ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 10

I. Representation: “We are the ones we’ve been waiting for.”²²

The Movement

To this day there is still much debate amongst scholars as to when Jim Crow officially ended and when the Civil Rights Movement began. There are a few main factors that contributed to the end of Jim Crow; the first being Brown v. Board of Education, second the growing political power of African Americans in the North, third the growing influence and reach of the NAACP, and finally the influence of WWII. While the Civil Rights Movement began taking root in the 1950’s, it would reach its peak in 1963. What started as a slow growing movement of Black student activists quickly mushroomed in the largest movement for reform that the nation had ever seen. This result was politically and racially motivated movements in over one hundred cities and the arrests of tens of thousands of protestors. Thanks to the actions of these brave individuals and their “demand that America live up to its stated ideals,”²³ a new impressive piece of legislation was decreed—the Civil Rights Act of 1964. This revolutionary act sought to dismantle the Jim Crow system in the South and intended to ensure greater equality and protections for African Americans. The following year, another groundbreaking legislative act passed in Congress—the Voting Rights Act of 1965. This act had the intended purpose to tear down barriers of voter suppression for African Americans and aimed to make possible the protection and investigation into race-based voter discrimination. These legislative accomplishments had sweeping affects as the percentage of African American voter turnout soared from 1964 through 1969.

Far too often, when the civil rights movement is spoken of, we are merely shown select sound bites from MLK’s “I have a dream” speech. But this tradition dates further back then that fateful march. The movement represents an imperfect coalition of ordinary people who, “were moving in unison to achieve what they hoped would be revolutionary change.”²⁴ To quote Baldwin, the civil rights tradition is a moment where those who’s price of the ticket was paid in full, were reminded of the people who have never denied their ancestry. Thomas C. Holt reminds us of all those that came before us, those that were treated as inferior, and those that were subjugated to segregation. “Segregation in practice was not simply a matter of separate seating, but the ostentatious making of one’s inferior status, indeed one’s literal untouchability.”²⁵ These imperfect coalitions represent hope for an unsegregated future, for a commitment to the power that derives from ordinary people who refuse the ticket, from those whose moral passion had an effect that created enduring change.

²²“Barack Obama’s Caucus Speech,” The New York Times, January 3, 2008, <https://www.nytimes.com/2008/01/03/us/politics/03obama-transcript.html>.
²³ Jonathan Eig, *King: A Life* (Farrar Straus & Giroux, 2023). Pg. 4
²⁴ Thomas C. Holt, *Movement: The African American Struggle for Civil Rights* (Oxford University Press, 2021). Pg. 5
²⁵ Thomas C. Holt, *Movement: The African American Struggle for Civil Rights* (Oxford University Press, 2021). Pg. 38

Our Imperfect Coalition

As Angela Davis reminds us, there is a special spirit in those who remember that “Freedom is a constant struggle.”²⁶ Through social protest, a commitment to radical nonviolence, and the transformative power of coalition—this tradition represents “a centuries old struggle to achieve and expand freedom for us all.”²⁷ Without which, the momentous victory of 2008 would not be possible.

“There is a reason why in 2008 there was such a planetary euphoria when Obama was elected. That a Black man who identified with the spirit of the historical struggle for Black liberation could be elected president of the United States was a cause for rejoicing everywhere in the world, because people everywhere have identified with this sustained struggle for freedom or what Cedric Robinson calls ‘the Black radical tradition.’”²⁸

America—at long last—despite remaining trapped in a logic of an unending civil war had finally rejected historical amnesia and built a coalition of our differences.²⁹ As we rejoice in what has become known as the Obama coalition—and the civil rights movement—which made Obama’s presidency possible; America was forced to reckon with the ghosts of its past. A ghost whose constant presence serves as a stark reminder that the civil rights movement would not have been needed had the logic of slavery been abolished in 1863. The Obama story remains trapped in the same systematic logic of the past—the system remains despite Obama’s triumphs.³⁰

In this respect, we must recognize the battles of the 1960’s was an attempt to rectify discretions from 1860’s, and 2008 became the battleground of the unfinished movement from the 1960’s. America has always been a constant struggle. And as Obama himself reminds us, “my life would have been impossible, my opportunities entirely foreclosed, without the social upheavals that were then taking place.”³¹ When slavery “ended,” the Ku Klux Klan was founded, Jim Crow segregation was put in place, the prison industrial complex began, communities became redlined, the war on drugs ravaged, and the movements leaders were assassinated. And yet, it is easier to praise ourselves as being the greatest country in the world, than to reckon with the same repeated mistakes. The sins of a country’s past brought about the movement. And it was the people—Dr. Martin Luthor King Jr., Malcolm X, Rosa Parks, Claudette Colvin, Carrie Lee Fitzgerald, Irene Morgan, and all those that came before and after—who made the movement a reality. “These are the people whom we have to thank for imagining a different universe and making it possible for us to inhabit the present.”³² A universe where an Obama presidency was possible, a universe where we can continue to build our imperfect coalitions.

²⁶ Angela Y. Davis, *Freedom Is a Constant Struggle* (Chicago, IL: Haymarket Books, 2016).
²⁷ Angela Y. Davis, *Freedom Is a Constant Struggle* (Chicago, IL: Haymarket Books, 2016). Pg. 112
²⁸ Angela Y. Davis, *Freedom Is a Constant Struggle* (Chicago, IL: Haymarket Books, 2016). Pg. 112
²⁹ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
³⁰ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
³¹ Barack Obama, *The Audacity of Hope* (Sydney, N.S.W Vision Australia Information and Library Service, 2009).Pg.29
³² Angela Y. Davis, *Freedom Is a Constant Struggle* (Chicago, IL: Haymarket Books, 2016). Pg. 118

What We Are Capable of Achieving

The civil rights movement and the Obama presidency are inextricably linked in both their achievements and their failures. As Ta-Nehisi Coates once said, “Barack Obama’s victories in 2008 and 2012 were dismissed by some of his critics as merely symbolic for African Americans. But there is nothing ‘mere’ about symbols.”³³ The victories achieved, and the heroic leaders of the civil rights movement are amongst the most important symbols of the 20th century. The 21st century’s symbol of progress is best represented in the Barack Obama presidency. And yet, we must also consider the 20th and 21st century’s greatest tradition continues to be the symbol of Whiteness. Disappointments aside, the movement and the Obama presidency are best compared when understanding the degree to which both could organize—of creating a coalition—to tell a different story about America.

“The greatest positive lesson from the 60’s for today embodied by the campaign of Barack Obama is the importance of organizing—of gathering people around the concerns of their lives to find common solutions.”³⁴

The Obama coalition is the symbolic representation of a broader American project with a reimaged identity which sought to overcome the deep stain of slavery.³⁵

Behind the slogans of “Yes We Can!”, “We Can Do This!”, and “Change We Can Believe in!” the Obama campaign brought people together, under a common purpose and moral passion that transcended political divides. As the civil rights movement brought us together under the moral universe of voting—the Obama presidency reinvigorated the very same moral promise. And like the 60’s, the Obama moment was made possible by a young electorate, who for the first time felt a sense of pride in what we are capable of achieving.

“Obama won overwhelmingly among 13 million people who were voting for the first time, claiming a massive 66% of the electorate aged 18 to 29, including 54% of young white males, a cohort that no Democrat had won since the 1960’s.”³⁶

I was amongst those first-time voters. For myself, and so many others, our votes weren’t won over because of Obama’s policies but because he was cool, and his vote was the cool vote. We weren’t voting for just some other White guy. It was in this moment where for the first time, American’s voted for courage, for hope, and most importantly, it was a vote to be a part of something greater than us. Just as there is nothing mere about symbols; there is nothing mere about representation and for the first time, American’s felt the power of both.

³³ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 295
³⁴ Brian Ward, “‘A Curious Relationship’: Barack Obama, the 1960s and the Election of 2008,” *Patterns of Prejudice* 45, no. 1–2 (2011): 15–42, <https://doi.org/10.1080/0031322x.2011.563143>. Pg. 19
³⁵ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
³⁶ Brian Ward, “‘A Curious Relationship’: Barack Obama, the 1960s and the Election of 2008,” *Patterns of Prejudice* 45, no. 1–2 (2011): 15–42, <https://doi.org/10.1080/0031322x.2011.563143>. Pg. 20

Rhetorical Rizz

Language matters, voices matter, and Obama’s rhetorical rizz became the vessel from which our cool president traversed America’s murky waters. Rhetoric serves as a conduit that enables the individual and the collective to flow as one.

“Whether in the form of a public speech, a pamphlet, a film, or a painting, rhetoric is simultaneously reflective and generative of the communal understandings necessary for active human subjects to coexist.”³⁷

His style of speaking, and his delivery had the ability to pierce our moral indifferences; a way to surgically cut through American hubris and nihilism.³⁸ Obama represented a return of the great American rhetoric.

The rhetorical rizz of Barack Obama became the stylistic entity which allowed him to toe the line between two worlds but never cross. As Coates once said, “he walked on ice but never fell.”³⁹ Of the many symbolic powers Obama had, his mastery of language and ability to cut through cultural differences and captivate his listeners became crucial to being elected in both 2008 and 2012. As far as America has come regarding racial progress, racial and ethnic identities are still very much formed by the construction and delivery of language. Alim & Smitherman state, “In America public discourse, language is often overlooked as one of the most important cultural tools that we have for distinguishing ourselves from others.”⁴⁰ It should then come as no surprise in the realization that White America and Black America have certain expectations and rules when it comes to language. So how then has Obama become known as the most gifted orator this generation has ever seen?

“Barack Obama was seen as someone who could speak directly and comfortably with folks across regions, generations, socioeconomic divisions, racial and ethnic groups, and political and religious views.”⁴¹

The answer is his ability to not only codeswitch but also style shift. This ability granted Obama both access and acceptance into two worlds that have been historically at odds. In this flexibility, Obama became the representation of what America ought to be. A melting pot of words and styles mirroring the reflection of a society as complex and stratified as Obama’s rhetorical rizz.

³⁷Derek Sweet and Margret McCue-Enser, “Constituting ‘The People’ as Rhetorical Interruption: Barack Obama and the Unfinished Hopes of an Imperfect People,” *Communication Studies* 61, no. 5 (2010): 602–22, <https://doi.org/10.1080/10510974.2010.514679>. Pg. 605

³⁸ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023

³⁹ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 297

⁴⁰ H. Samy Alim and Geneva Smitherman, *Articulate While Black: Barack Obama, Language, and Race in the U.S.* (Oxford University Press, 2012). Pg. 3

⁴¹ H. Samy Alim and Geneva Smitherman, *Articulate While Black: Barack Obama, Language, and Race in the U.S.* (Oxford University Press, 2012). Pg. 5

Dreams of a Post-Racial America

If America was what it ought to be, the flexibility and piercing abilities of Obama’s rhetorical rizz might have served as a permanent fix to a country whose war has never ended. Reality told a different story. An unintended consequence emerged known as post-racial rhetoric. A new set of rules were created that sought to place expectations and rules on how Black’s might enter White America. As Enid Logan writes,

“It differentiates between good Blacks ‘like Obama’ and the more problematic Black others. Contemporary racial discourse speaks, then, about the Black poor, viewed largely as problematic and undeserving. But the evidence is that it also increasingly differentiates between the Black poor and Blacks who are more affluent; establishing moral boundaries between the groups and codes of proper conduct.”⁴²

Here lies the paradox of America, reflected in Obama’s speech on race where he announced, “I will never forget that in no other country on Earth is my story even possible.”⁴³ A paradox that allows for a Black man to be elected president but at the same time, tells society how they should talk and act to become a part of White America. The system remains despite the triumphs of the Obama Coalition.

The Obama story was one of great hope for what we are capable of achieving but what came after is a far more truthful telling of what America is and what it is not. Any dream of a post-racial America was just that, a dream or a myth. While the Obama presidency represented a time to reject racial amnesia; instead, a new machinery of racial fear arose—a racial backlash in lieu of the post-racial democracy we dreamed of.⁴⁴

“The deep denial of race matters in American history—with notable exceptions like the civil war or the civil rights movement—is an example of the more profound denial of empire matters in the emergence and sustenance of America. America was a business project before it became a democratic experiment.”⁴⁵

Well, the civil war continues in the logic and ideals of a country that long ago paid the price of the ticket. And the great progress and coalition that is the civil rights movement remains unfinished. In the fear of what the Obama’s coalition might tell, a

⁴² Enid Logan, “Barack Obama, the New Politics of Race, and Classed Constructions of Racial Blackness,” *The Sociological Quarterly* 55, no. 4 (2014): 653–82. Pg. 654

⁴³ Transcript: Barack Obama’s Speech on Race,” NPR, March 18, 2008, <https://www.npr.org/templates/story/story.php?storyId=88478467>.

⁴⁴ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023

⁴⁵ Cornel West, *Race Matters* (Boston: Beacon Press, 2018). xvii

retelling of America’s oldest story reemerged. The story that long predates the Obama coalition—the ghost of the production and reproduction of ignorance that metastasized in the form of the MAGA movement.

“The political triumph of Donald Trump is a symbol and symptom—not cause or origin—of our imperial meltdown. Trump is neither alien nor extraneous to American culture and history. In fact, he is as American as apple pie.”⁴⁶

When our story had a chance to be told through representation, disappointment decided to steal the show. This is the nexus of American excellence and the American tragedy. For as Baldwin says, a true telling about America “would reveal more about America to Americans than Americans wish to know.”⁴⁷

II. Disappointment: “Democracy can buckle when we give in to fear”⁴⁸

*My President Was Black*⁴⁹

The seemingly inconceivable victories by Barack Obama in 2008 and 2012, represented a time of reclamation, revival, and a time when freedom was equal among neighbors.⁵⁰ During those eight years in power there was a deeper understanding that something beautiful was possible in the United States. That the prohibition of a Black man in the White House was over. Obama’s victories were a political milestone and a momentous leap in the direction of social progress, but there certainly was a deeper symbolic meaning for the Black community. His victories conclusively validated a Black person’s will to thrive in an educated, political world, and that Black people could be the true representation of what it means to be American.

To better understand the power symbols hold, the examination of the longest standing symbol of American history needs to be addressed—the badge of Whiteness. The badge of Whiteness holds a power of advantage, a symbol which has represented an elevated status over the Black person. “For some not-insubstantial sector of the country, the elevation of Barack Obama communicated that the power of the badge had diminished.”⁵¹ The hope was that the moment in history which would lead to a post-racial America had finally arrived, but “racism would not allow a Black president.”⁵² In fact, fear of diminished status for White society and progressive animosity has intensified racism in the United States. It is in this fear of diminished status which has enabled perverse misinformation of Obama’s birth to surface—the start of the birther movement. The goal of the birther movement was to delegitimize Obama’s presidency and, in that effort, more than a dozen states had created legislation demanding to

⁴⁶ Cornel West, *Race Matters* (Boston: Beacon Press, 2018). xviii
⁴⁷ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 101
⁴⁸ “President Obama’s Farewell Address,” National Archives and Records Administration, accessed December 14, 2023, <https://obamawhitehouse.archives.gov/farewell>.
⁴⁹ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 291
⁵⁰ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁵¹ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 296
⁵² Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 126

see proof of Barack Obama’s birth in the United States. It is because of this disgusting, racist movement that more than half of all Republicans were estimated to believe this misinformation. Under this white supremacist hubris is where the denial that our president was Black began. “If Obama is not truly American, then America still never had a black president.”⁵³ As the smoke began to fade and the embers of the old racial hierarchy began to smolder, a fresh breath of oxygen ignited a new inferno of racism that came in the form of a messianic figure for white supremacy—Donald Trump.

Before we move on to the Presidency of Donald Trump, I want to talk about what might be the most infuriating aspect of Barack Obama to White America—the fact that Barack Obama chose to be Black. As Ta-Nehisi Coates states, Obama’s statement “he decided to be a part of that world,” may be the most incredible sentence ever written in the long, decorated history of Black memoir.⁵⁴ While there is no doubt in my mind that Obama faced his share of racism in his life (as every person of color does at some point in their lives), he was mostly shielded from America’s worst racial dimensions by being born of a White mother and raised in Hawaii. He came from a family that was not only well traveled but was able to put him into the finest private educational institutions, so the fact is the inner-city Black experience was abstract to his upbringing— “he decided to be a part of that world.”⁵⁵ In White America it is supposed to be the opposite for a person of color. When a Black person reads, gets an education, and becomes a success, it is because that person had abandoned their Black identity in favor of being accepted into the White world. This is the paradox which both confounds and infuriates the racial hierarchy. How can the most successful Black person in American history have chosen to be a part of the inferior race? It is in this choice, this statement, this revelation, where Barack Obama has garnered the admiration “My President was Black.”⁵⁶

When speaking of former president Donald Trump, it is imperative to be candid in the fact that his accent to the White House stemmed from the birther movement and made possible through the passivity and tradition of whiteness. This is a man who called for the death sentence when speaking of the Black teenage suspects that were later exonerated, known as the Central park Five; the man who offered 5 million dollars to see Obama’s transcripts because he couldn’t believe Obama possessed Ivy League intelligence, the man who launched a campaign against Mexican “rapists” (who was just recently found liable for sexual assault), the man who publicly brags about not paying taxes, the xenophobic, misogynist, Islamophobic White man who presided over chaos and misinformation. It would be naïve, ignorant, thoughtless, to believe Donald Trump could become president if he wasn’t White. Not only White, but The White Knight meant to bring back order and power to the hierarchy. He is unique in that he didn’t just follow his White predecessors as president, he became the symbol for White Supremacy—this is what Ta-Nehisi Coates meant when he states Donald Trump is “America’s first white president.”⁵⁷

⁵³ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 134
⁵⁴ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 304
⁵⁵ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 304
⁵⁶ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 291
⁵⁷ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 344

However, America’s first White President is not the disease, or the virus, he is merely the symptom of the cancer that is American racism. Donald Trump was not elected president because he was White, not because he was loud, obnoxious, and hateful, he was elected president because of the backlash that was created by America’s first Black president. He is the example of how the toxicity endures. The myth of racism continues to fester in the minds of the thoughtless. “Race is the pure indifference between you and me that does not exist.”⁵⁸ Following slavery, Jim Crow, redlining districts, the war on drugs, and the assassinations of Malcolm X and Dr. Martin Luther King Jr, the creation of the caste of the incarcerated; America’s unending war continued in the presidency known for the phrase “grab em by the pussy.” It is in this realization, where we must recognize the Trump phenomenon did not come out of nowhere— “He is the product—whether or not he is the culmination is up to us—of a long fomenting and incubating project.”⁵⁹ This presidency is another chapter in a war fought amongst neighbors and it will not end with Donald Trump if we continue to live in a world of double consciousness—“A world where one feels his two-ness—an American, a Negro; two souls, two thoughts, two unreconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder.”⁶⁰

A War Amongst Neighbors

If the Obama coalition represented a time of reclamation, a time when America had accomplished something not only despite but built on our differences; then what came next may be characterized as the antithesis of that moment. What came next is representative of the greatest disappointments that have plagued America. What came next tells us something about our origin—where and how this country started. The Trump presidency can best be described as the worst human compulsions to act on violence; our willingness to turn against our neighbors. In which, the most violent of human tendencies became mashed together by the will of fear, panic, government, religion, and sovereignty. And with this stew of cruelty was served a regenerated commitment to inequality and indifference—that has not only sought to dispose of freedom itself but further the gap between the human condition and our right to have rights. As Kumar describes regarding Arendt’s frustrations with societal cruelty and indifference,

“Herein lies her baffled frustration with their willingness to destroy this freedom as quickly, in a thoughtless combination of barbarism and indifference. Freedom and barbarity have often hidden each other in their very hearts, after all, and under suitable conditions, even intensified each other.”⁶¹

Once again barbarity has become banal, and at the heart of this political cruelty is human will to dominate over the minority, like that of Nazi Germany. A not so subtle or even unique quest for

purity. In this sense, has humanity's desire for state sanctioned violence been patiently waiting for its moment to awaken from its slumber? Has this new demagogue reawakened a dormant societal desire that is compelled to control, pervert, and subjugate those who are deemed unworthy, or un-grievable? Trump has once again made cruelty political and in doing so, has opened an old wound which has continued to fester in the mind and soul of America: a kind of vengeance that is both repetitive and unaccountable, a violence that is both invisible and excessive, and a justification that displays both casteism and racism—it is systematic.

When cruelty is allowed to inhabit the realm of liberal democracy, the line between politics and moral values disappears.⁶² This line has completely vanished in the politic of Trumpism—and birtherism—the political strategy used as the cornerstone to a campaign built on the fragility of truth. In recognizing Donald Trump began with the birther movement, one can surmise his ascent was not only propelled but launched into orbit by what Judith Shklar in her essay titled, “Putting Cruelty First,” calls, “the most evil of all evils—cruelty.”⁶³ It is this cruelty—his intention to both be cruel and to disfigure the morality of the human—which has enticed an entire swath of the American populous to embrace a rhetoric around racial purity: “the production and reproduction of moral illiteracy.”⁶⁴ And as moral illiteracy has been allowed to run rampant, so too has the American desire to tell a different story about our past. In this sense, Trump has embraced lying in politics, he has become the embodiment of the disappointing return of the colonial quest for racial purity and a delusional pursuit of centralized governmental dominance, but from the start, he has been sincere in his desire to disfigure the very soul of contemporary civilization. Trumpism disfigures, cruelty disfigures, lying disfigures— and “cruelty, like lying, repels instantly, because it is ugly. It is a vice that disfigures human character.”⁶⁵ As this lie has continued to grow, as the American soul continues to disfigure, as our amnesia intensifies, so too has the manifestation of nationalism—American fascism felt at home⁶⁶—best known as MAGA.

The Cynical Man

“Cynicism is the language of the masters.”⁶⁷ In what may be described as the kindling to indifference and political cruelty, cynicism has become an important constraint used leading up to and during the Trump presidency. A presidency of moral laziness, where nihilism has been allowed to contaminate the soul, creating the cynical man. It has been theorized that political cynicism is an important asset to a party—or leader—that seeks to impede progress. “Political cynicism contributes to the stability of an authoritarian regime because it encourages people to sit at home rather than protest on the street. Political cynicism is useful for the survival of an authoritarian regime as it eliminates the imagined possibility of alternatives to the status

⁵⁸ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁵⁹ Catherine Albiston et al., *Trumpism and Its Discontents* (Berkeley, CA: Berkeley Public Policy Press, 2020). Pg. 1
⁶⁰ W. E. B. Du Bois, *The Souls of Black Folk: Essays and Sketches* (Archivald Consabel & Co., 1905).
⁶¹ Aishwary Kumar, “A Jurisprudence of Neglect: Arendt, Ambedkar, and the Logic of Political Cruelty,” *Faith in the World: Post-Secular Readings of Hannah Arendt*, 2021, <https://doi.org/Berlin & Chicago>. Pg. 205

⁶² Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁶³ Judith N. Shklar, Putting Cruelty First, April 2, 1981, <https://www.jstor.org/stable/20024800>. Pg. 81
⁶⁴ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁶⁵ Judith N. Shklar, Putting Cruelty First, April 2, 1981, <https://www.jstor.org/stable/20024800>. Pg. 82
⁶⁶ Aishwary Kumar, *American Institutions and Ideals: Lecture* (Cal Poly Pomona, CA, 2018). Sept 28, 2023
⁶⁷ mutant: hope

quo.”⁶⁸ It is in this recognition where we might best be able to interpret a language used to quell the imagination of what the Obama coalition represented. A language that spoke of distrust, cruelty, purity, indifference, and most certainly the fear of what a reimagined America might look like. It is this nihilist—cynical—threat that one can surmise what has become an existential threat to a politics of hope. Where the capacity for human disregard has become not only prominent but put first in this logic of the cynical man.

“Nihilism is to be understood here not as a philosophic doctrine that there are no rational grounds for legitimate standards or authority; it is, far more, the lived experience of coping with a life of horrifying meaninglessness, hopelessness, and (most importantly) lovelessness. The frightening result is a numbing detachment from others and a self-destructive disposition toward the world. Life without meaning, hope, and love breeds a coldhearted, mean-spirited outlook that destroys both the individual and others.”⁶⁹

There is nothing new about nihilism in America, in fact one might say that it is quite banal. As Cornel West reminds us, nihilism in Black America has always sought to sequester moments of great progress that broke the shackles of oppression. The Obama presidency and what came next is just the latest destructive endeavor meant to prolong this un-civil war. A motionless endeavor capitalizing on both political cynicism and nihilism because it has the power to not only impede progress but “sterilize bottom-up political challenges to the regime.”⁷⁰ The kind of bottom-up participation that demands something greater from its politics; a kind of imagination of what America could look like if only it had the courage to demand and reach for the progress of change. And yet, there is a political virtue which holds the potential to finally end this un-war; a moral world where society has not—and will not—succumb to the rampant thoughtlessness and indifference represented in the nihilist hubris of the politics of the cynical man. A politic based on a lie, an acceptance of what has always been lurking within the moral fiber of a country which has time and again paid the price of the ticket. A delusional quest for purity that has unearthed not simply because of a Donald Trump but because of a nationalist disease of the soul. So, what might end not only this un-war but also the nihilist threat that is the cynical man? The answer lies in the face of despair, an unwavering commitment to a political virtue often dismissed because it is seen as fragile, or as Ambedkar would say, “a weak force.” And yet, it is this fragile, weak force which reminds us of what it is to be human.

“Hope as that redemptive counter force that meets nihilism at its most indifferent moment. And opens a different vision, a different possibility, a different prospect of being human.”⁷¹

⁶⁸ Paul Shields, “Killing Politics Softly,” *Communist and Post-Communist Studies* 54, no. 4 (December 1, 2021): 54–73, <https://doi.org/10.1525/j.postcomstud.2021.54.4.54>.

⁶⁹ Cornel West, *Race Matters* (Boston: Beacon Press, 2018). Pg. 14

⁷⁰ Paul Shields, “Killing Politics Softly,” *Communist and Post-Communist Studies* 54, no. 4 (December 1, 2021): 54–73, <https://doi.org/10.1525/j.postcomstud.2021.54.4.54>.

⁷¹ Mutant: hope

III. Hope: Yes, we can!

“Hope is not blind optimism. It’s not ignoring the enormity of the task ahead or the roadblocks that stand in our path. It’s not sitting on the sidelines or shrinking from a fight. Hope is that thing inside us that insists, despite all evidence to the contrary, that something better awaits us if we have the courage to reach for it, and to work for it, and to fight for it. Hope is the belief that destiny will not be written for us, but by us, by the men and women who are not content to settle for the world as it is, who have the courage to remake the world as it should be.”⁷²

What We Can Reimagine

We inhabit a world encapsulated by a false binary. Where we are told that our only option lies in our ability to be violent. We are told it is human nature. If we don’t act first, then we will become the victims of violence. This is just the way the world works, one might say. In the opening pages of James Baldwin’s *The Fire Next Time*, he writes to his nephew in fear of what will happen to him if he fails to imagine a different possibility.

“You may be like your grandfather in this, I don’t know, but certainly both you and your father resemble him very much physically. Well, he is dead, he never saw you, and he had a terrible life; he was defeated long before he died because, at the bottom of his heart, he really believed what white people said about him.”⁷³

How many of us are defeated long before we die? What happens when imagination is replaced by nihilism? This is the crime of America, the lie of immobilization. The immobilized man is one who is stuck within the cycle of violence and counter-violence. Unable to move, unable to imagine what may be possible, if only he had the ability to take the next step. It’s not that we are not capable, it’s not that we have never broken free before, it’s that we have been snagged by the clutches of confinement. Our ambition has become limited by what we cannot see. The shackles of the oppressor are no longer chained around our legs, they have built a wall around our minds to contain our imagination of what could be.

The radicalism of hope breaks down the walls that have confined our imaginations. The radicalism of hope—Obama’s hope—reimagines what a world can look like when we have the courage to take the first step towards a radical new vision. As Eddie Gloude Jr. reminds us, “first steps are always important. We must exhibit the courage and willingness to take the risk and step out on faith with the hope that our rocky start will give way to more confident strides.”⁷⁴ America needs to take such a step, we need to make that confident stride without taking two steps back. Reconstruction was a step forward, but it was quickly followed by Jim Crow (two

⁷² Barack Obama: 2012 presidential election victory speech (transcript-audio-video), accessed April 6, 2024, <https://www.americanrhetoric.com/speeches/barackobama/barackobamasecondpresidentialvictoryspeech.htm>.

⁷³ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 4

⁷⁴ Eddie S Glaupe Jr, *Begin Again* (Chatto Windus, 2021). Pg. 208

steps back), the Civil Rights Movement was a giant leap forward towards equality but that too was followed by another two steps back during Reagans War on Drugs and Poverty. It has been said that what King started in Montgomery was finished in 2008 when the first Black president was elected to office. This was the moment Black America had been waiting for. A moment where the shackles of the oppressed were supposed to be removed for good, the moment when the defiant were finally seen and heard. America’s third reconstruction was swiftly followed by another two steps back. What happened next—Donald Trump—was not simply a reaction but a long fomenting project of America’s past. It was caused by an immobilizing panic and fear that continued America’s confinement. What came next is the result of our lack of imagination. No matter the outcome, we still must move forward together. But where do we go from here?

The answer lies within the radicalism of hope. This is a reimagining of what can be. Here we lie at the crossroads of our moral highway. We must find that which has been confined by our own immobilization. We must find hope. Obama was a symbol of what hope could be, and yet, we were still unable to commit to a new form of politics. The lesson we must learn is that true change can’t be achieved through the hopes of one man. It takes a collective reimagination. Obama reinvigorated our imaginations, but it was not enough, MLK brought us to the ballot, but it was not enough. We still move forward. Hope must be found in these moments of despair. It is our only way to get back up again. James Baldwin never gave up on the idea that we can be better, he never lost his hope, he was unhopeful. Our unhope must become the foundation of this reimaging I speak of.

“We need to gather ourselves, for we are in the eye of the storm. We must find the courage to make the bold choices necessary for these after times. And we cannot shrink from our rage; it is the fire that lights the kiln. We have to look back and tell a different story, without the crutch of our myths and legends, about how we have arrived at this moment of moral reckoning in the country’s history. We must do our first works over, and this requires an imaginative leap of faith.”⁷⁵

When we are at our worst moments of despair, we must not become part of the evidence of things not seen, we must have the capacity to mourn together in the face of despair. We must find it in our hearts to forgive but never forget. For forgiveness is the only action which can break the cycle of violence, because it is the rejection of amnesia and the embodiment of self-discovery. We must build a coalition to not just voice our grievances but to come together in celebration to heal the American soul. And finally, we must take that imaginative leap of faith that the radicalism of hope requires. This is how we find the fire this time. We must remember “that we, with love, shall force our brothers to see themselves as they are, to cease fleeing from this reality and begin to change it.”⁷⁶

⁷⁵ Eddie S Glaude Jr, *Begin Again* (Chatto Windus, 2021). Pg. 216

⁷⁶ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 10

In the Face of Despair

Hope is the premise of a better future, a better self, a better soul, a world that’s moral universe does indeed bend towards justice. But how do we—humans—begin to understand how to create a more hopeful world? I fear that far too often hope is thought about as a passive feeling, or better yet, it becomes confused with optimism. There is a difference. Where optimism is a confidence that something better will happen, hope is something far more transformative, it is both active and engaged in creating—not just believing—a better future. So, when, and where do we find moments when we can truly be hopeful? Here lies the paradox surrounding hope—hope can best be understood in the face of despair. Just maybe, hope is evidence of the deepest darkest layers of oneself, the scars so deep the world will never see, yet the same scars that shape our very existence. Tragedies have so much power in our lives; they in some tragic way determine who we are, in what Judith Butler calls, “the transformative effect of loss.”⁷⁷ The loss of a friend, a parent, a partner, a child, a life. Loss is a human inevitability, and due to this fact, we all must stare into the face of despair on many occasions in one’s lifetime. Loss, though tragically, has a magical power that is morally grounding, it has the ability to bring together across time and space—to shed the “I” and create a “we.” For we all can share in this one tragic human condition, we must all, at some point, mourn the loss of someone we love.

When we lose someone, we love—especially but not exclusively—an unexpected loss, one is suddenly forced to examine what in that person one has lost, and at the same time, what in oneself is lost with that person. One loses their innocence, their childhood ceases to exist, or they are finally able to shed the immaturity that has for too long held them back. Whatever it may be, some sense of one’s previous self-dies, too, alongside the loss of life. Through this process of mourning and grief, we are reminded and connected on this vast web of body and soul. That humans cannot be “human” in isolation, and thus, we must concede that we all need each other and that our body and soul are always vulnerable. This is not to say we can’t reach a level of independence but that “the body has its invariably public dimension.”⁷⁸ To the Israeli soldier, to the violent sheriff, to the angry kid who is lost in despair—every Palestinian life matters just as much as your own, that Black body does not deserve to be beaten, broken, and arrested, and putting a gun in your hands will not heal your pain. For violence is a disease, and a disease cannot be cured by spreading to others.

Far too long, fear, anxiety, panic, and rage have been used as a vessel for the disease. The populous has succumbed to a commitment, not to the inoculation but to the virus's transmission. It is never the job of the whole to extinguish this infection, it is the responsibility of every individual, each infected person. Change, real change, happens daily in each encounter we have, every moment we are tempted but resist violence. It can be as simple as a smile and casual as a conversation. It is in these daily reminders where we are shown how interconnected our lives really are. We must not fear what we may lose, we must embrace the grief that resides in us all, and through this process of mourning we examine what it truly means to be human.

⁷⁷ Judith Butler, *Precarious Life: The Power of Mourning and Violence* (London: Verso, 2006). Pg. 21

⁷⁸ Judith Butler, *Precarious Life: The Power of Mourning and Violence* (London: Verso, 2006). Pg. 26

Though we are all in pain, although we all have fears, our pain and fear are never in isolation. The capacity to transcend our divisions resides in the building of “us” and “we.” And through this doctrine of tolerance and togetherness we—together—have the capacity to build a more hopeful world. This is the radicalism of hope. And it is so radical because it is so hard to reach. Hope is brittle, sometimes it may seem distant, it is always trying; but a commitment to radical hope is the only answer when searching the moral universe of healing—it is the transformation action meant to free the world.

In a world ravaged by the effects of violence and war, hope and forgiveness are seen as feeble emotions. Not political virtues of nonviolent resistance. For one, hope—like any form of nonviolence—is seen as being weaker than violence. Hope and forgiveness are seen as cowardice, where cruelty and punishment become the language of the brave. A language loudly spoken to the masses, a language which desires not the transformative power of coalition, but the regression and isolation of man into immobilizing nihilism and cynicism.

“Surrounded by desolation, confronted with our greatest barbarisms, to have hope is to commit ourselves to movement, to getting back up again without being apologetic about our disappointment with humanity itself.”⁷⁹

And yet, it is exactly this virtue the nihilist regime disregards which has the potential to end this un-war. For it was the hope of a better future—a future of freedom—that must have kept those bodies that were broken and brutalized under the evil of slavery from giving up. It is hope for a better life the stateless person must believe in when seeking a land of promise. It is the hope our voices will be heard, the hope we can make a difference, that gives the uniting action of protest the power of solidarity. For hope cannot be individualistic, it is a virtue of unification. Our county’s greatest disappointments have always been rooted in nihilism because it tears apart, it destroys the collective, it brutalizes and blinds the soul of humanity so all that appears is the darkness of despair.

“Hope seems like a thread you can hang by rather than change your existence with and through. But precisely because it is a thread one hangs by, precisely because one refuses to let go of it, precisely because there is always hope even when there is not, hope becomes the oxygen of politics.”⁸⁰

However, it is precisely when one meets the face of despair that hope becomes a true force of nonviolence. For the power of hope lies not in the life of the perfect human. True hope resides in the moments of utter despair; the moments when one loses faith in progress, the moments when justice is so far out of reach that it seems impossible to grasp, the moments when life itself is hanging by the balance. For it is in these true moments of impossibility that one’s faith in hope—a faith in humanity—where the capacity to cope together may be achieved. These are the moments when the human reemerges into the political realm. “To understand hope, is to understand what makes us human. To understand hope is to understand why we must retain our humanity, no matter how unlivable the human itself becomes.”⁸¹ To be human is to be

⁷⁹ mutant: hope
⁸⁰ mutant: hope
⁸¹ mutant: hope

political, and to be political is to be hopeful that the world can change. It is this commitment to a politics of hope that the Obama presidency reimagined the power of togetherness. And despite all odds to the contrary, despite the inevitability of what came next, and despite what lies ahead, our hope remains, our hope has strengthened, and our hope has only grown in the face of despair.

A Time for Forgiveness

“Within the veil he was born, said I; and there within shall he live, —a negro and a negro’s son. Holding in that little head—ah, bitterly! —the unbowed pride of a hunted race, clinging with that tiny dimpled hand—ah, wearily! —to a hope not hopeless but unhopeful, and seeing with those bright wondering eyes that peer into my soul a land whose freedom is to us a mockery and whose liberty a lie.”⁸²

Despair has no better friend than the parent of the lost soul of a child. In this searingly despairing passage, Du Bois encapsulates the true meaning of unhope. A hope in a future that may one day break the shackles of its chains, only to be taken while still in the crib. Death seems to almost mock him as he dreams of a future beyond the veil. And yet, hope must remain; a hope that his lost child has found peace, a sadness that this child may never reach the potential beyond the veil in this life, but a realization a future beyond the veil does in fact exist—if only for now in the hopeful unseen beyond this mortal world. “Surely there shall yet dawn some mighty morning to lift the Veil and set the prisoned free.”⁸³ For Du Bois himself, he still lays beyond reach, as he, unlike his son, has awoken to see another morning, “but Love sat beside his cradle, and in his ear Wisdom waited to speak.”⁸⁴ This love he speaks of, the love needed to bring a child into the world, knowing that he may spend his entire life behind the veil, is a love rooted in forgiveness. For it is through the wisdom of forgiveness that brings hope into an unforgiving world. The virtue of forgiveness gives the living soul the capacity to move forward. Not to forget—never to forget—but to move forward with nonviolence in the heart. For forgiveness is a commitment to always remember, and to seek progress in the souls of oneself and the neighbors who have maintained the veil. We all have the capacity to forgive, for freedom can only be attained by the opposite of vengeance.

“Forgiving, in other words, is the only reaction which does not merely re-act but acts anew and unexpectedly, unconditioned by the act which provoked it and therefore freeing from its consequences both the one who forgives and the one who is forgiven.”⁸⁵

⁸² W. E. B. Du Bois, *The Souls of Black Folk: Essays and Sketches* (Orinda, CA: Seawolf Press, 2020). Pg. 128
⁸³ W. E. B. Du Bois, *The Souls of Black Folk: Essays and Sketches* (Orinda, CA: Seawolf Press, 2020). Pg. 130
⁸⁴ W. E. B. Du Bois, *The Souls of Black Folk: Essays and Sketches* (Orinda, CA: Seawolf Press, 2020). Pg. 131
⁸⁵ Hannah Arendt, Danielle S. Allen, and Margaret Canovan, *The Human Condition* (Chicago: The University of Chicago Press, 2018).

In an un-war, amnesia and vengeance become the foundation of a world devoid of forgiveness. A vicious cycle of violence and counterviolence in which politics become impersonal. Where humans cease to be human in the eyes of those who forget. It is in this dehumanization that vengeance is permitted its chain reaction, where punishment and war become endless. Forgiveness, therefore, is the only action that does not react violently, nor does it embrace amnesia, but becomes the paradigm for a new kind of politics. A politic which embraces the virtues of hope and forgiveness to redefine the human condition. Forgiveness brings back the human in politics and in doing so, permits what has been historically irreversible to be corrected. Forgiveness allows love to take humans out of isolation and begin to build anew. A world of us and we, a world of coalition and solidarity amongst neighbors. “Forgiving and the relationship it establishes is always an eminently personal (though not necessarily individual or private) affair in which what was done is forgiven for the sake of who did it.”⁸⁶ But to achieve a world of forgiveness, the individual must first forgive themselves before forgiveness can become political.

The American story has been one of intentional amnesia about the past crimes that have stained the soul of the country. It is in this sense American to expect in some magical way that the sin of slavery will vanish without the intense self-discovery that forgiveness demands. This is the work of a generational commitment. Just as white supremacy has lived on by its own sort of commitment, so too must the much harder work of forgiveness. It may seem infeasible—possibly irresponsible—for Black America to forgive the past transgressions of those who raped, murdered, brutalized, kidnapped, and maimed their forefathers. But it is not the responsibility of the descendants of the broken and brutalized to forgive, for they will never forget and in this sense, forgiveness has already been granted. It is the responsibility of white America to forgive itself, to remember a history it would sooner forget. Forgiveness at its core is a reminder of who we are, where we came from, and what we are capable of. The brutality of white supremacy has certainly changed over the years; segregation is no longer written on signs and posts, there are no longer slaves picking cotton, no longer is lynching a regularity. There are however gross inequalities felt by the Black community, the war on drugs, the caste of the incarcerated, police brutality, redlining and the blaming of the Black community for their own failings. This is how this un-war has continued, this is what makes a war without end. “The sins of slavery did not stop with slavery. Slavery was but the initial crime in a long tradition of crimes, of plunder even, that could be traced into the present day.”⁸⁷

The case for reparations presented by Ta-Nehisi Coates is a chance for white America to forgive itself. While arguments against reparations are certainly numerous, most notably America’s unwillingness to recognize itself for what it is. A country which became the leader of the free world, a constitutional democracy which guarantees freedom but in the very same

⁸⁶Hannah Arendt, Danielle S. Allen, and Margaret Canovan, *The Human Condition* (Chicago: The University of Chicago Press, 2018).

⁸⁷Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 158

breath allowed said freedom to co-exist with slavery. “For Americans, the hardest part of paying reparations would not be the outlay of money. It would be acknowledging that their most cherished myth was not real.”⁸⁸ The myth that we—Americans—can escape our history, that we have no need to forgive. Our worst nationalistic tendencies have birthed out of this myth, and so too has the ideals which allowed for a Trump presidency, so too has a culture of neglect and indifference. Forgiveness rejects this myth; it would not allow for another presidency of neglect and indifference. It would however reveal the sins of the past and present so that the future, however unlikely, reaches a new kind of politics with the desire to transform society into a moral universe that does indeed bend towards justice. Such a world requires patience, a commitment to forgiveness, and the hope—no matter the odds—that we can reimagine humanity.

Civil Disobedience is a Vibe

“What greater expression of faith in the American experiment than this, what greater form of patriotism is there than the belief that America is not yet finished, that we are strong enough to be self-critical, that each successive generation can look upon our imperfections and decide that it is in our power to remake this nation to more closely align with our highest ideals?”⁸⁹

There is something very tragic in the lives of young American’s today; that at the heart of each young life, violence has been abstracted from the body. There is a distance between the realities of war the rest of the world has felt, there is a lack of visibility of the broken. An inequality of the injured body that allows Americans to offer “thoughts and prayers” from a safe distance. Civil disobedience disrupts one’s distance, it places one’s body in the line of fire, it makes us choose to be active. “To act is to be committed, and to be committed is to be in danger,”⁹⁰ as James Baldwin reminds us. For when we are committed to the movement, we embrace the idea of radical equality—the political virtue that transformed America during the Civil Rights movement—and made a call to action that made each human body equally injurable. There is a transformative effect that takes place when our bodies are put on the line, together in solidarity. There is a courage that emerges when we refuse to hide the evidence of things left unseen. When violence is met with the force of nonviolence, “my dungeon shook and my chains fell off.”⁹¹ For many, specifically the communities of those who are far too often left unseen, the protection distance offers are neither a reality nor a desire, for protection is a fundamental of inequality. The Civil Rights movement refuses this distance manufactured by the

⁸⁸Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 159

⁸⁹“Remarks by the President at the 50th Anniversary of the Selma to Montgomery Marches,” National Archives and Records Administration, accessed May 14, 2024, <https://obamawhitehouse.archives.gov/the-press-office/2015/03/07/remarks-president-50th-anniversary-selma-montgomery-marches>.

⁹⁰ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 9

⁹¹ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 10

privileged, and the Obama presidency reinvigorates our imagination of what a world that refuses to look away could be. Civil disobedience is the vibe that makes hope active and breathes life into the lungs of humanity—it is what is truly exemplary of the American experiment.

On March 7th, 2015, on the 50th year anniversary of the Selma to Montgomery Marches, President Barack Obama celebrated the courage of ordinary folks that demanded Americans to stare into the abyss of injustice. The events that transpired 50 years ago from that day were not isolated from history, nor were the brave folks who put their bodies in harm’s way in isolation. Those brave folks walked in the memory of slavery, Jim Crow, Emmett Till, the economy the South built on the backs of the broken. Those brave folks built a coalition that would transcend their moment in time; because they sought to stay true to their North Star and keep marching towards justice.⁹² For when we, the people, build a coalition, we build something so imperfect that its image reflects what America could be. White, Black, Brown, straight, gay, young and old come together to form a movement for change. Selma is not an outlier; it is of many moments of exceptionalism that represent a tradition born in America. Activism is never static, it is the embodiment of movement, it is the courage to be or freedom. Activism acknowledges what those of us who refuse to let things go unseen know: that America—and freedom—are a constant struggle. “It requires the occasional disruption, the willingness to speak out for what is right, to shake up the status quo. That’s America.”⁹³ That’s what makes us exceptional. That’s what brings hope to the hopeless, that’s what reminds us of what we can accomplish when we have the courage to become one of many, to shed the protection identity offers for the power of solidarity, and it is the vibe which can only be felt when one is willing to make their body an immovable object, when one refuses to exit before confrontation.

“If we want to honor the courage of those who marched that day, then all of us are called to possess their moral imagination. All of us will need to feel as they did the fierce urgency of now. All of us need to recognize as they did that change depends on our actions, on our attitudes, the things we teach our children. And if we make such an effort, no matter how hard it may sometimes seem, laws can be passed, and consciences can be stirred, and consensus can be built.”⁹⁴

In Hannah Arendt’s *The Crisis of the Republic*, she reminds us “the civil disobedient shares with the revolutionary the wish ‘to change the world,’ and the changes he wishes can be drastic indeed.”⁹⁵ When ordinary folks have the courage to join in open defiance, they not only look to become part of a movement seeking change, but they are also themselves become

⁹² “Remarks by the President at the 50th Anniversary of the Selma to Montgomery Marches,” National Archives and Records Administration, accessed May 14, 2024, <https://obamawhitehouse.archives.gov/the-press->

⁹³ “Remarks by the President at the 50th Anniversary of the Selma to Montgomery Marches,” National Archives and Records Administration, accessed May 14, 2024, <https://obamawhitehouse.archives.gov/the-press->

⁹⁴ “Remarks by the President at the 50th Anniversary of the Selma to Montgomery Marches,” National Archives and Records Administration, accessed May 14, 2024, <https://obamawhitehouse.archives.gov/the-press->

⁹⁵ Hannah Arendt, *Crisis of the Republic* (Harmondsworth: Penguin, 1973). Pg. 77

changed. Civil disobedience becomes necessary when populations feel unheard and unseen, when they become convinced that their representative government no longer functions in their best interests, but civil disobedience is symbolic of much more than grievances of the unheard. Civil disobedience is a celebration. It is not simply a place to voice outrage but a place to heal, to feel community and to find hope. When we put our boots on the ground, our bodies on the line, when we stand hand in hand with our neighbors, we represent the most beautiful idea of America; an intermingling of cultures, heritages, art, music and life itself. We become the embodiment of democracy. And it belongs to everyone. Where we were once hopeless in isolation, we become part of something transformative. This is the action of dreamers; those that stand in defiance before the status quo, those that imagine what is possible if only we have the courage to stand our ground, those that take the first steps towards progress. We are the hope we have been waiting for. We are unconstrained by habit and convention. Unencumbered by what is, because we’re ready to seize what ought to be.⁹⁶

The Radicalism of Hope

“It’s the hope of slaves sitting around a fire singing freedom songs; the hope of immigrants setting out for distant shores; the hope of a young naval lieutenant bravely patrolling the Mekong Delta; the hope of a mill worker’s son who dares to defy the odds; the hope of a skinny kid with a funny name who believes that America has a place for him, too.”⁹⁷

The Obama coalition—Obama’s hope—was the belief that there was an innocence about America. An innocence that despite all evidence to the contrary, America was still morally good. This was the power of Obama; he was able to successfully navigate both Black and White America without alienating either. He brought us together by reimagining and reinvigorating the hope of what we all want to believe. That America is exceptional and that we do possess the moral fiber of a nation built on the imperfections of a true democracy. There are those who will criticize Obama as naïve for this belief in American innocence, but this foundation has allowed him to have the audacity to hope. It wasn’t that he closed his eyes to the violence of America’s history, it’s that he had a hope for a new story about America. Like his presidential portrait painted by Kehinde Wiley, he envisioned a prism refracting a rainbow backdrop, a power found in the vibrance of America’s color spectrum. Transparent to the eye, but able to disperse through the beauty of our imaginations.

As we sit on the precipice of a looming disaster, the possibility of political collapse, we must once again turn to the beauty of our imaginations. Obama pulled America out of the worst economic crisis we have seen since the Great Depression,

⁹⁶ “Remarks by the President at the 50th Anniversary of the Selma to Montgomery Marches,” National Archives and Records Administration, accessed May 14, 2024, <https://obamawhitehouse.archives.gov/the-press->

⁹⁷ Ta-Nehisi Coates, *We Were Eight Years in Power: An American Tragedy* (London: Penguin Books, 2018). Pg. 298

but now we must become the leaders we have been waiting for, we must begin again as James Baldwin reminds us. Radical divides have deepened, animosity has grown, trust has disintegrated but still we remain. For those of us willing to begin again, we must not turn to a prophetic savior, we must build a new kind of hope around ordinary folks. Instead of embracing the vibrance of America’s color spectrum, we have become shrouded in the fog of violence. Its not that we are not capable of escape, we have just lacked the imagination of what comes next. Obama decided to enter this vibrant world, he took the leap of reimagining a future beyond the fog of violence, beyond the veil.

“That was the best of the American spirit, I thought—having the audacity to believe despite all the evidence to the contrary that we could restore a sense of community to a nation torn by conflict; the gall to believe that despite personal setbacks, the loss of a job or an illness in the family or a childhood mired in poverty, we had some control—and therefore responsibility—over our own fate.”⁹⁸

Here we must return, it is in our audacity that the radicalism of hope emerges. From the depths of what has been, awakens the faith in a promised land. It will take the imagination of Obama, the vulnerability of Baldwin, the insight of Arendt, the force of Butler, the fire of Coates, and the love of King to make America what America must become.⁹⁹ Perhaps I’m merely lost within a dream, but what a beautiful dream it is. I see a future where our moral passion—our love for one another—transcends our political divides. I imagine a world where our children and children’s children will have long forgiven us for our failures. It is the time to put violence first as we commit to reshaping the world around us. This world of nonviolence I imagine is possible, but only if we have the courage to make it a reality. The change we seek is in our hands. No matter how many times we fall, no matter how much we hurt, no matter the odds, we will have the strength to have hope, we will begin again. The world is waiting for you, ready to be changed.¹⁰⁰

⁹⁸ Barack Obama, *The Audacity of Hope* (Sydney, N.S.W Vision Australia Information and Library Service, 2009). Pg.356
⁹⁹ James Baldwin, *The Fire next Time* (New York: Vintage International, 1993). Pg. 10
¹⁰⁰ “Pres. Barack Obama at 2007 Academy Summit,” Academy of Achievement, September 7, 2020, <https://achievement.org/video/barack-obama-2007/>.

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Gomez
Nolan* The Bioaesthetics of DIY Concerts

D. Background research with analysis and summary of literature review:

 I began theoretical research by finding the foundations of my theory. I used my theory to inform my hypotheses of interconnectivity between biopolitics and bioaesthetics. I believe this relationship, as studied in my literature review, shows characteristics of creative resistance in art production. In my capacities as a music/gig worker in both Sacramento and Pomona, I have found a healthy and communal rapport with small-artist communities. This allows me to pursue my studies in ethnography with little to no alteration or intervention in the activities of these communities. This gives my research into both the music industry and bioaesthetics new potential for analysis. Further, as a queer and mixed-race researcher I am given a peek into different realms of discourse that operate within the same social and economic circles. Doors seem to only lead to other doors.

Background reading:
Mandel, David - Changing Art, Changing Man
Mandel, David - Bioaesthetics: Art and the Evolution of Man
Strathausen, Carsten - Bioaesthtics: Makings Sense of Life in Science and the Arts
Hannah Arendt - The Human Condition
Benjamin, Walter - Illuminations
Benjamin, Walter - Critique of Violence
Agamben, Giorgio - Man Without Content
Agamben, Giorgio - Homo Scacer

 In my reading of Mandel and Strathausen, who have published the most comprehensive works of theories defining Bioaesthetics, I have found both room for contesting and concurring. Strathausen attempts to use Bioaesthetics as a means of critiquing Biologism and expresses support for the conception of “The Sensory Being” which is a theory that comprises that sensory experience gives understanding unto material reality, and there is a key element of creative power and choice within human experience that cannot be reduced to a mere understanding of the mechanisms of biological systems. This applies to DIY concerts specifically in the escapist and fantastical qualities of the concert apparatus. Subjects both performing and consuming the art that is being produced. Mandel’s specific concentration on the creative power demonstrated by art and its relation to other subjects helps ground my study of DIY concerts in the observation of artistic processes as power processes.

 Arendt, Benjamin and Agamben all have theories in the listed works surrounding the use of bodies and the art’s relation to it. Arendt expresses that politics itself can be understood as an art, leading me to wonder if the co-operative nature of the underground arts can be understood as a politics, inverting Arendt’s assertion. Benjamin’s theses on the concept of history as well as his critique of violence serve to understand both violence and the recording of that violence as a means of expressing a political will. I am curious about the dynamics involved in a DIY concert by creating shared memories and histories amongst communities through artistic gatherings. Does the study and recording of these gatherings allow for a more balanced understanding of art’s history as a system of cultural genesis? This is where Agamben’s contribution in his first work of aesthetics as well as his famous Homo Sacer. It is through the state of exception that the

B. Abstract:

DIY Concerts are self-organized and self-managed music performances composed of networks of working-class music workers. Any concert in which an artist or artist group is responsible for the majority of art is considered a DIY Concert. These scenes are often referred to as DIY or “Do-It-Yourself” because they do not wait for the record label, the manager, the agent or bigger artist to sign them from one performance. They sometimes occur in venues, self-regulated by the artists on the bills in an economic agreement with the venue owner. Other times, they are found in backyards, in street lots, at pop-up markets and art galleries. I am becoming increasingly enthralled with the study of how art affects populations. In this particular study, how music creates cultures of resistance in underground music scenes. By avoiding major labels, commercial management or booking channels DIY concerts show examples of system building outside of corporate influence.

Bioaesthetics is a field of critical theory regarding the biological implications of art; Namely, how art is a byproduct of evolution and may have capabilities of resistance against the material conditions of contemporary politics. The artist and the spectator remain strangers to one another in most commercial operations of the music industry. One of the more community-based and personal approaches to live music arrives in self-organized and sustained scenes. They are seeking longevity and a way of life in the arts that is only now possible through new advances in computing power and music technology. This relates to bioaesthetics as art allows us to advance in new ways according to our relation to materials and production of art objects. Through participatory action research and ethnographic field work, I have been immersed in the culture of small-artist communities. They share stages, equipment, spaces and cities and are interconnected through both their specialized knowledge base and their means of expression.

 In the study of the **Bioaesthetics of DIY Concerts** I aim to describe the conditions that allow for this new modality of art production in underground spaces. I am faced with three main questions: How do material conditions inform practices of resistance and space-making? How do hierarchies of power affect the organization, relationships and collaborations between artists? How does art affect small-artist populations in terms of cultural genesis?

C. Major objective(s):

 First Objective: Better define DIY concerts as self-organized music production as a result of small-artist populations exploring their capacities as artists amongst each other. I am seeking to understand how music works as an evolutionary adaptation under the framework of Bioaesthetics. If there are dimensions of power to art production, in what ways is that power present in DIY Concerts? How might findings in my ethnographic field notes and interviews compare to other established theories surrounding art’s use and effect on population.

figure of the artist finds itself in such a liminal period. It is through a growing consciousness surrounding the capacities of the artist that a new use, and perhaps purer means of resistance can be found in art. Any form it may find.

E. Methods (Experimental procedure/design):

I have been conducting ethnographic field notes as a means of analyzing emergent themes and values present in the communities I am studying. I attend concerts regularly as they hap-hazardly spring up in underground artist channels. I attend these shows and participate in them either as a music-worker or spectator, then perform my critical actions within my ethnographies upon returning from the site or in my direct conversations with subjects who co-experienced this night with me. Due to the changing and modular nature of these concerts, I must be prepared to have a modular approach to recording this data and maintaining an accurate accounting of the character of these communities of artists.

F. 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):

In my two concert-outings so far since being approved by the IRB, I have discovered consistent qualities in both populations within the DIY concert atmosphere. For example many of the artists who perform in rented out rooms attached to restaurants, storefronts or markets rarely make enough money to participate in the activities they decorate with their sounds.

There are distinct hierarchies in regards to power, discourse and access to materials to create music. These social circles and systems both maintain values of entire genres and conflict with various political leanings within different artistic camps. For example: Gender parties on the basis of gender presentation and performance are often enforced by particular venues, galleries and promoters. This means trans, queer, and non-comforming folks are pushed to the margins to allow for a reductive understanding of gender in spaces of art production. The collective intentions

Cont. Spring Semester Mar 7

I have now attended 16 Music worker events, 12 of which were DIY concerts, 4 of which were music worker meetings related to the mobilization or organization of their work. These sites and conversations have been immensely illuminating. They have forged a solid understanding of select values and methods of action within the scene that show proof of music as a form of power. This relates well with the frameworks and written works found in my bibliography. This research has allowed me to test out my still-forming ontology and epistemology regarding my field. Bioaesthetics is a small and disconnected field; few of the writers who use the verbiage have identical research interests as the field has interdisciplinary roots. It has emerged from various pockets and cul de sacs of knowledge and is now in danger of being misused by parties of ill intent. The goal of my works is to find a postcolonial resistance method in the formulations of culture production given our contemporary means of consumption and production.

Final Continuation and Findings Spring Semester May 15 2024

At the moment of writing this final passage, I will say I have attended 19 music worker events. 14 of which were concerts, 7 of which were music worker meetings. In my research I have collected a multitude of ethnographic field notes detailing the specifics. Music workers come together to create safe spaces of creation for each other.

How do material conditions inform practices of resistance and space-making?

It is with strong inference I believe there are two different philosophies to art that run themselves towards opposite poles. While both of these practices contain a commercial and a ritual/ceremonial element. commercialized concerts and DIY shows have similar ambitions but different means and slightly different ends. Both projects come from a portion of the population who desire to sustain themselves from their craft, however there are clear barriers based on access to resources, capital and spaces. DIY shows present an alternative to major label and higher industry methods of music consumption. DIY Shows offer a strong look at the resolve of the underground artist. They are resilient, facing all kinds of adversity when it comes to booking venues or even collaborating with other artists. Not only was I able to get a grip on the process of the DIY concert, its periods of setting up and taking down. Understanding that the concert is much more of a process than a solitary spectacle occurring in a vacuum. It requires thought, intention, coordination, collaboration, trust and respect in order for these shows to go well. Many of the shows I attended in backyard settings were some of the most rambunctious but most caring. I went to a punks for palestine show, here are some of my notes:

“Punks for Palestine occurred in a suburb in Northern Sacramento. At least five bands in the sacramento punk scene were in attendance. I found it immensely powerful that the creatives in my nearest city were able to collectivize their resources in such a way to benefit a just cause. I do not want to trail too far from my initial research focus, but the Palestinian movement has proven yet again the waning of America’s soft power. The continued disapproval of imperial actions and sanctions in leftist segments of music scenes has been a recorded phenomenon since the Harlem Renaissance, Jazz, and Blues movements of the early 20th century. If we were to dig even deeper, Work songs from enslaved populations offer some of the most foundational roots in resistance to the American political project. Work songs were used by ancestral populations of Native American tribes for a variety of reasons. Some tribes like the Navajo would write songs in appreciation of nature’s power and the landscape’s gifts to their community itself. Whereas the Cheorokee used their music to focus on narrative structure and oral tradition. All of this lends to my understanding of the Bioaesthetic current and its applications here in this backyard - which must be filled with at least 400 people. People are dressed in edgy and dark attire but exude warmth to each other with abandon. The counterculture of today appears to be some incarnation of a radical acceptance. I cannot tell if this is a communal acceptance of the severity of our material circumstances - domestic and abroad, or the acceptance that the implosion of its perpetuation will not come without work. Either way, this radical acceptance practiced by this punk scene in the face of a devastating conflict which has induced so much pain is of great interest to me. It creates a reflective/introspective experience for one to lose themselves to the intended purpose of the music’s call. War songs in Native populations also prepared the more agricultural and conflict-adverse tribes such as the aforementioned Navajo and Cheorokee, as well as Comanche and Lakota tribes. It is important to note that the methods

of war that Native Americans utilized are not the same draconian methods of war that European Colonial Powers inflicted upon them. My reason for mentioning the Native American tribal musical traditions and the communal approaches to resistance in Sacramento has to do with the nature of the Palestinian resistance to occupation.”

You can tell a lot about an audience by the music they consume and why they consume that music. Punk’s harshness reflects the harshness of life. I went to a few rap shows and many more alternative shows, this is not because of preference but because of availability. As a rap musician myself I understand the micro and macro aggressions that come along with associating yourself with that genre. Hip-Hop is still viewed by venues as dangerous and distasteful, even though this has been one of the most popular genres in the world since 2016. Hip-Hop is now an international cultural movement. While punk bands get booked a bit more often inside of venues, it is often supported by DIY methods of showrunning. I was able to test out many ideas that I read in terms of bioaesthetic theory. **How do hierarchies of power affect the organization, relationships and collaborations between artists?** There were also biopolitical implications regarding how the music produced new forms of subjects through the apparatus of the DIY concert itself. At many of these shows, fundraisers and pamphlets were common. A spread of community knowledge can be attained at many of these shows, and if it is not intellectually stimulating it is still aesthetically stimulating. You will meet the artists whose music you consume in person. You can treat them like your peers.

How does art affect small-artist populations in terms of cultural genesis? As an audience, we still consume art as a commodity as is contingent upon our capitalist system. However the purpose for these concerts goes beyond plain commercial interest. There is a real investment in creating spaces for an underground to exist. If we are blacklisted and excluded as a mass from most venues big or small and are unsupported by platforms of cloud capital like Spotify and Apple Music, we must not wait for capitalists to build alternatives for us. We as the music workers must use our skills to build systems of cultural production as a means of safety and self-preservation. As an artist our goal is to put out work in the world at affects people and ultimately, is aesthetically pleasing for us. As we use the resources around us in coordination with our knowledge of genre and our skill sets acquired over time, we can generate new sounds and thus new culture to be reacted to by an audience. An audience who does not solely exist to consume, but to produce art of their own as well. There lies a thread of biopolitical inspiration in the wake of the construction of the inspirational apparatus. An apparatus that lies between a second person consicoussness and our inspired state of mind.

G. 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?

My project has had a late start, but overall I believe I am on track in acquiring sites of research and data collection. My methodologies and research questions are well versed and prepared for more engagement in the field. I have had consistent meetings with Dr. Jain about making my scope more precise for individual projects in order to build a more-bolstered field of inquiry. My long-term intention is to expand the discipline of Bioaesthetics but I must start with one field note at a time.

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Gonzalez Jessica* How Disparities and Stigma Contribute to Mental Health Underutilization Among Asian and Latinx American College Students

Abstract

While universities and colleges offer mental health resources to a wide range of students, these resources may not adequately address the specific needs of Asian American and Latinx college students who are facing psychological distress due to factors unrelated to their academic life. There has been limited research conducted to investigate and evaluate their lack of utilization of mental health resources at colleges and universities, which would subsequently highlight the factors that contribute to their help-seeking behaviors. There is a need to challenge the dominant Eurocentric therapeutic model while considering alternative strategies that address and recognize diverse experiences of individuals. The current research examines the challenges experienced by Asian American and Latinx college students that may result in low utilization patterns. This study aims to bridge the gap in research using a cross-cultural approach with the goal of understanding how to improve resources for underrepresented groups by modifying the existing resources to cater to their unique experiences. Through a comprehensive examination of Asian Americans and Latinx college student’s perspectives on mental health, the study seeks to recognize the discrimination and microaggressions they experience. At the same time, it analyzes the relationship between stigma, helping seeking behaviors, and utilization patterns. The current qualitative study utilizes surveys and semi-structured interviews to explore their utilization of mental health resources, stigma toward mental health, and any barriers towards the help-seeking behaviors among Asian American and Latinx college students. The participants (n = 8) self-identify as Asian American or Latinx college students from California State Polytechnic University, Pomona. The preliminary findings of the thematic analysis revealed that when a therapist possesses an in-depth comprehension of the student's cultural context, linguistics, and

unique obstacles they might be encountering, it increases the likelihood of the student seeking mental health resources. Although students encounter stigma outside of school through different avenues, campus resources need to consider these underrepresented student’s factors that are affecting them. By expanding on multicultural approaches that increase accessibility and by considering family dynamics, this study will help improve mental health resources that acknowledge the unique individual experiences of these intersecting identities.

There is an increase in information on mental health by numerous studies researching improving mental health awareness and providing access to those resources. College campuses offer mental health resources that students can utilize when in need. Perceived discrimination among Asian Americans and Latinx college students has been linked to an array of adverse psychological outcomes, including heightened levels of distress, thoughts of suicide, state anxiety, trait anxiety, and depression (Hwang & Goto, 2009). Using a qualitative approach and interviewing Asian and Latinx American college students, the research aims to find common themes and factors in identifying similarities between cultures, family cohesion, immigration, model minority myth, and generation status. Both cultures have ethnic minorities that consist of substantial immigration populations susceptible to discrimination stemming from xenophobia. Moreover, both groups share a collectivistic cultural orientation, potentially resulting in analogous reactions to instances of discrimination (Vandello & Cohen, 1999).

In the United States, ethnic minorities face many challenges posing increased problems that warrant them to seek psychological help (Snowden & Yamada, 2005; U.S. Department of Health & Human Services, 2001). The mental health stigma they face of being ashamed or weak for having psychological issues and the disparities both Asian and Latinx college students experience play a role in how the underutilization amongst these two cultures experiences,

results in low utilization rates (Abe-Kim et al., 2002). Simultaneously, the research examines the obstacles and hurdles faced by Asian and Latinx college Students. It aims to bridge the gap in research and allocate additional resources to these underrepresented groups, tailoring the available resources to their specific needs for greater benefits. By exploring their perspectives on mental health, the study seeks to identify the stigmas and disparities they encounter. This knowledge will contribute to developing strategies for restructuring mental health programs or resources, aiming to accommodate their unique firsthand experiences better and considering their bi-racial identities.

Family Factors and Generation Status

A range of factors impacting mental health utilization among underserved Latinx and Asian Americans have been the subject of several studies. Asian and Latinx Americans, as minority groups in the U.S., prioritize the importance of family and encounter similar challenges related to acculturation and immigration (Chang et al., 2013). College students from Latinx and Asian cultures cherish the concept of familism, which entails demonstrating unwavering dedication, commitment, and loyalty to their immediate and extended family members through consistent and meaningful engagements (Chang et al., 2013). Latinx Americans depend on their extended family for emotional solace, exemplifying a safeguarding role that effectively diminishes the necessity for external support beyond their familial circles (Altarriba & Bauer, 1998). College students may not always seek out family members for support because of their relation factors contributing to their generation status, family conflict, and familial bonds they have. For individuals from Latinx and Asian cultures, family context provides a critical context for understanding help-seeking behaviors (Change et al., 2013). The vital importance of family

within Asian and Latinx cultures reflects a mutual emphasis on collectivism, highlighting the pivotal role of family as a valued in-group and source of social support (Triandis et al., 1988).

In Asian and Latinx cultures, a strong emphasis on collectivism and familism holds significant importance within these cultural contexts. The experiences of Asian and Latino Americans show commonalities, and the extent to which they encounter cultural conflicts within their families may vary depending on their generational status (Chang et al., 2013). In comparison to Latino Americans, first-generation Asian Americans may encounter more challenges in their family relationships across different generations because of the stressors they face while adapting to a new culture, even though they have strong and close-knit family ties (Chang et al., 2013). Third generation Latinx Americans experience a heightened desire for independence which can exacerbate tensions within their families. This increased need for autonomy can contribute to strained relationships and conflicts within the familial unit (Chang et al., 2013).

Several findings within research articles have demonstrated that family context plays a significant role in mental health-seeking behaviors. Asian Americans' decisions are delayed in seeking mental health treatment due to family and cultural conflicts affecting them. In comparison, familial ties and familism in Latino Americans can be beneficial or restrictive (Chang et al., 2013). Although their thoughts of family support, they may receive messages of the stigma associated with mental health. First and second-generation individuals face an elevated risk of experiencing intergenerational family discord, particularly among second-generation Asian Americans who may encounter challenges associated with the acculturation gap (Hwang & Wood, 2009). There are cases where Latino and Asian Americans grapple with significant family and cultural conflicts. Cohesive families provide means of referring their

family members to mental health treatment, while these families view it as stigmatizing to disclose mental health problems to others outside their social circle (Ta et al., 2010). Disharmonious and conflictual family ties could be a potential source leading to interpersonal distress that may initiate help-seeking behaviors (Abe-Kim et al., 2002). Compared to third-generation Asian Americans, immigrants who had more familial ties were less likely to utilize mental health services (Ta et al., 2010).

Model Minority Myth

Mental health is important but usually overlooked by Asian Americans because of the stigma of seeking professional care (Lee et al., 2009). The model minority myth falsely assumes that all Asian Americans are highly intelligent and successful, which creates a division between different minority groups and causes harm (Cheng et al., 2016). Within traditional Asian culture, there is a belief that mental health problems stem from a lack of self-control, resulting in a perception of shame surrounding disclosing such issues or seeking help (Lee et al., 2009). The source of their psychological distress among Asian American students is discrimination due to the stereotypes of the model minority myth attributed to their high success and successful economic status. The stereotype omits mental and physical health problems in Asian Americans by painting a light on this group of always tackling challenges and working hard despite the discrimination they have encountered. According to Cheng (2009), besides the low undocumented rates of mental health issues among Asian Americans, there are subgroups (e.g., Asian American women, elderly, college students, and teenagers) exhibiting higher levels of depression and suicidal ideations. Depression and suicidal ideations may be attributed to Asian cultural pressure on Asian American college students of academic success of having to be perceived as “the good son or daughter” by demonstrating high grades, participating in

clubs/activities, and achieving high-status jobs. Despite the success of Asian Americans, it carries a toll of sacrificing one’s mental health and psychological well-being which begins to display signs of depressive symptoms.

The model minority stereotype negatively impacts various other ethnic minority groups (Wang & Santos 2023). This stereotype implies that ethnic minority groups bear personal responsibility for their shortcomings while disregarding the systemic factors that perpetuate racial disparities. By doing so, it upholds the status quo and overlooks historical and current systemic issues that play a significant role in these disparities. Specifically, Asian Americans experience detrimental consequences due to the perpetuation of stereotypes, which inaccurately generalize and wrongly assume that this minority group does not face social, economic, or political obstacles on their path to success (Lee et al., 2009). Also, individuals who internalize the myth may base their identity on how they measure up to the myth and subsequently struggle with the burden and pressure to be successful (Chan & Mendoza-Denton, 2008). The stereotype exacerbates disparities within Asian cultures by focusing on the relative success of Asian Americans compared to other diverse Asian communities effectively overshadowing the challenges they face. The model minority stereotype overlooks mental and physical health problems within diverse Asian American communities (Chou & Feagin, 2008). Internalizing the stereotype builds potential barriers for Asian Americans, as it may lead to a lack of recognition and support from mental health providers and professionals who disregard their struggles due to the pervasive nature of the model minority myth. By not having recognition of their hardships, Asian American college students may encounter cultural and economic barriers of professionals not understanding their languages and cultures.

Interracial conflicts manifest differently, including dividing Asian American students from other racial minority groups. The minority myth portrays Asian Americans in a glorified manner as academically, economically, and socially successful within American meritocracy (Yoo et al., 2010). The model minority stereotype within academic settings conveys a message to other minority groups that Asian Americans have successfully overcome discrimination, leading to the question of why other groups are unable to achieve the same level of success (Rosenbloom & Way, 2004). The stereotype effectively conceals the challenges experienced by Asian American youth who do not conform to this stereotype such as Southeast Asian Americans, Cambodian, Laotian, and Vietnamese Americans, who tend to belong to lower socioeconomic classes compared to Chinese, Japanese, Koreans, and Asian Indians (Leong et al., 2011). Unfortunately, the model minority stereotype renders their hardships invisible, neglecting their social issues. The stereotype itself overlooks varying levels of success and experiences in Asian American communities (Leon et al., 2011).

Stigma and Discrimination

College students experience various discrimination and stigma linking mental health with academic performance and educational attainment (Pascarella et al., 2004). Even though universities and colleges offer counseling centers for Asian and Latinx college students, personal problems interfere with their abilities to function successfully in academic environments (Lockard et al., 2012). While encountering personal challenges, Latinx Americans often face discrimination, leading to heightened psychological distress and depressive symptoms. A study conducted by Hwang and Goto (2008) showed that Latinx students were more likely to be accused of wrongdoings (e.g., stealing, cheating, or breaking the law) than their Asian American counterparts, leading to higher levels of stress. Latinx-American students, often possessing

darker skin tones, may face a heightened risk of being targeted due to harmful stereotypes that wrongly associate them with criminal behavior. A different study by Arbona and Jimenez (2014) examined Latino students attending a diverse college campus and revealed that they expressed minority stress was associated with depression after monitoring for general college stress. The study demonstrated that student’s perception of the campus climate was unwelcoming to Latinos associated with depressive symptoms (Arbona & Jimenez, 2014). Mental health resources among campuses with diverse populations sometimes won’t have the necessary information to help students who experience psychological distress for several reasons outside of school. Similarly, Asian Americans who experience discrimination also tend to encounter adverse effects on their psychological well-being and experience increased levels of psychological distress (Yoo & Lee, 2005).

Experiencing mental health stigma in various social and professional settings could harm Asian Americans. Studies have shown that higher education may reduce stigmatizing attitudes toward mental illness (. However, higher levels of education may endorse more significant stigma due to the loss of reputation and likely to conceal the hospitalization of their relatives with mental illness (Phelan et al., 1998). Stigmatizing attitudes toward mental illness in Asian cultures can be influenced by traditional values, such as adherence to societal norms, emotional restraint, pursuing family recognition through achievement, and practicing filial piety (Abdullah & Brown, 2011). Asian cultures have values of conformity and collectivism, emphasizing the group over the individual. Mental illness may be viewed as interfering with the group's needs and a lack of discipline, blaming the individuals for their mental illness (Chaudhry & Chen, 2019).

Similarly, Latinx cultures view mental health negatively by stigmatizing it and devaluing help-seeking behaviors. In the Latinx culture, Latinos uphold collectivistic values, emphasizing the family and community over the individual. Studies have suggested that individuals in Latino families with mental health disorders report mental health barriers because treatments are viewed as leading to embarrassment (e.g., vergüenza) or shame and how it can reflect on the family (Marquez and Ramírez García, 2013). Some sociocultural practices in this culture prefer self-reliance and informal counseling from family members to avoid professional counseling to protect their family honor. Latinos depend on trust to confide in their family; however, some Latinos are more inclined to self-concealing because of social stigma, internalized stigma, and fear of the family shunning them.

English-proficiency

Language barriers pose problems for both the Asian and Latinx communities because individuals who are immigrants may have trouble with English. Low-English proficiency (LEP) could impact both communities, leading to miscommunication with healthcare providers and deleterious effects on those navigating the healthcare systems (Kim et al., 2011). LEP potentially has critical barriers to mental health services for Asian and Latino immigrants, sporadically, there may be some facilities that do not have available bilingual service providers and interpretation services (Kim et al., 2011). Asians and Latinos may not be aware of mental health services due to the circumstances of having to work two jobs, lack of transportation, and insufficient information provided to them. Our study hypothesizes that Asian and Latinx American college students underutilize mental health services due to a lack of consideration for cultural and other relevant factors. Given that many college students from these backgrounds highly value family and familial support, it is crucial to explore their stories on how mental

health services and resources can effectively incorporate these aspects within collectivistic cultures. Additionally, we examine how qualitative data could aspire to integrate shared similarities into mental health resources that can enhance help-seeking behaviors for individuals with bi-racial backgrounds. By considering racial and ethnic disparities, we also investigate other potential factors that may impact college students, including family backgrounds, generational differences, limited information available for minorities, and experiences of discrimination.

Methods

Personal Characteristics: Two bilingual and bicultural undergraduate research assistants who have received training in conducting qualitative data collecting through in-person semi-structured interviews. The study procedures were overseen by the co-principal investigator, who has a PhD, and is currently an assistant professor at California State Polytechnic University, Pomona. During the research, principal investigators used reflexivity by openly discussing the potential bias that could arise from their own cultural background and their previous experiences working with the Asian American and Latinx communities.

Relationship With Participants: There was no preexisting relationship with any of the participants prior to the start of the study. As a component of the consent procedure, every participant was provided with information regarding the objectives of the research. The interviewers identified themselves as undergraduate psychology students from California State Polytechnic University, Pomona. Their objective was to study help-seeking behaviors and views about mental health among Asian American and Latinx college students.

Study Design

Theoretical Framework: Qualitative research is a method that entails gathering and examining data to investigate the viewpoints, ideas, and counters of individuals. A socioecological intersectionality approach (Jackson et al.,2016; Reupert, 2017) was used to examine the influences on the mental health help-seeking behavior of Asian American and Latinx college students. The socioecological intersectionality approach prioritizes the examination of participants' real-life experiences by conducting interviews and using thematic analysis to identify recurring patterns (Byrne, 2022).

Participant Selection and Setting: The study included undergraduate students who self-identified as belonging to the Asian American and Latinx population. Participants were recruited through the utilization of on-campus resource centers such as the César E. Chávez Center for Higher Education and the Asian & Pacific Islander Student Center, as well as social media platforms like Instagram. The recruitment process involved posting flyers and prompting individuals to sign up by scanning a QR code. After finishing a preliminary questionnaire, eight students expressed their interest. The participants were contacted via email and 8 individuals consented to partake in the interview portion of the study. We were unable to contact other interested participants due to the chosen method of communication and the proposed timeline of the overall study.

Data Collection

The research team developed a semi-structured interview with thirteen open-ended questions. The questions were created to investigate the perceptions on mental health, utilization of mental health services, and barriers in accessing campus resources among Asian American and Latinx college students (**Table 1**). Both researchers met with the participants face-to-face, where they discussed the interview process and gathered consent through written and spoken

means before starting the interview. The interviews were conducted exclusively in English, with a duration ranging from 45 to 60 minutes each. The research team manually transcribed the audio-recorded interviews.

Table 1

Topic and example interview questions

Topic	Example questions
Mental Health Definition	What does mental health mean to you? How has your environment shaped your perception of mental health?
Utilization of Mental Health Resources	Do you recall anyone in your family utilizing any mental health resources, or would they seek help through other sources? How do your cultural values affect the way you access mental health resources?
Family’s perception of mental health	Was mental health talked about in your family? If so, was it a negative or positive topic of conversation, and how did your family respond to this topic?
Limitations and Barriers Accessing Mental Health Resources	Did you experience any barriers or limitations when accessing mental health resources? Are there adequate mental health resources that cater to your cultural background and experiences? How do you think we can increase accessibility to more culturally relevant and sensitive resources?

Study procedures were approved by the Institutional Review Board at California State Polytechnic University, Pomona.

Data Analysis

Data analysis was conducted to ensure that there was an adequate amount of data to draw a conclusion with a satisfactory number of themes. Both the principal and co-principal investigators thoroughly reviewed all the transcripts, transcribed them, and familiarized themselves with the data. The transcripts underwent reflexive thematic analysis to discern

patterns among the material (Byrne, 2022). The researchers' adoption of a reflexive method facilitated a more comprehensive understanding of the many interpretations of the participants' experiences (Byne, 2022). Pseudonyms were used to protect and conceal the identities of the participants.

Each researcher thoroughly analyzed the eight interviews, extracting codes during the transcription process and getting familiar with the data. Utilizing a conceptual framework, each researcher independently determined codes (Naeem et al., 2023). The team met to discuss the codes and developed a master coding list. They collected significant statements from the interviews. Accordingly, there were a total of 31 codes, but 9 of them were used to eliminate repetition (**Table 2**). The researchers individually examined all the transcripts and collectively assigned codes to all the interviews, incorporating them into the master coding list. After coding the interviews, they underwent a process of review and revision before being grouped into themes based on emergent patterns. The research team was presented with the results for validation and to initiate the development of a reflexive thematic map.

Table 2
Table of themes, sub-themes, and definitions

Code/Sub-themes	Theme	Definitions
Family dynamics	Family	Family has a critical role in the help-seeking behavior of the individual.
Lack of conversation of mental health Family support in accessing help Inner conflicts and emotional barriers Cultural reluctance to ask for help	Saving Face	Avoid humiliation or embarrassment and do not tarnish family’s reputation.
Language barriers	Barriers	Recognizing and addressing cultural barriers in accessing

Cultural, religion, and familiar challenges in mental health		mental health
Cultural perspectives on trauma and stress Enhancing cultural competence	Cultural Relevance	Addressing language and cultural diversity in mental health care
Addressing social stigma and community perception Cultural taboos and stigma surrounding mental health Cultural awareness and stigma in help-seeking Culture of achievement	Stigma	Fear of the perception others when seeking mental health resources
Asian American mental health Tailoring mental health support to diverse cultural needs Need for long-term therapy on campus	Model Minority Myth	A stereotype that Asian Americans are smart and don’t need any assistance
Intersection of religious influence Integrating religion and spirituality into mental health	Resources	Empowering students’ engagement with mental health services
Cultural misinterpretation of mental health disorders Cultural and linguistic complexity in mental health	Religion	Addressing mental health with the use of religion
	Idioms of distress	Cultural differences and interpretations of mental health topics

Findings

The interviews consisted of 8 people, with 4 being Asian American and 4 being Latinx. The participants showcased ethnic diversity, varied generational statuses, and pursued different academic fields. The thematic analysis identified nine distinct themes: family, saving face, barriers, cultural relevance, stigma, model minority myth, resources, religion, and idioms of distress. Four unexpected themes emerged: the significance of attitude alignment, intersectionality of mental health perceptions, the interplay between individual

identity and generational context, and the challenges involved in prioritizing mental health among academic overloads.

Family Influence

Discussions of mental health help-seeking behaviors demonstrated the importance of family influence having an impact on seeking mental health resources. Participants in the study described their experiences of how mental health was absent during conversations. One participant stated, “Within my family’s background, this wasn’t ever a topic in the conversation.” (Cameron) and another said, “family really never talked about mental health... it wasn’t a thing we talked about.” (Riley). Although there was an absence of mental health in the participant’s family’s conversation, their support contributes to help-seeking behaviors. One participant said,

“My family is very understanding with a lot of things... my family’s openness has always helped me know that if I ever need something I could go to them. Or like if I need to access help, they’ll be there to help me access help.” (Riley)

Participants said that family beliefs are a factor of how they view mental health, especially when they have specific perspectives and sets of beliefs, there is going to be reluctance in seeking mental health resources. Participants described negative experiences communicating with family resulted in the inhibition of communicating feelings regarding mental health concerns. Participants expressed that lack of understanding regarding mental health impacts the participants’ decisions to seek resources. Whereas participants who had family more open to the idea of mental health were more likely to seek it. Also, participants had families that were part of psychology and helped bridge the gap in exposure with diverse types of mental health resources.

“That’s a discussion we had with our family... this is going on. We see that maybe the ways things are going right now might need a little more support from different perspectives.” (Cameron)

A participant reported having a mental illness, although family did not understand it, they tried to find support and help by searching for resources for the mental illness. Another participant described having a family member experience a period of distress resulting in the family coming together to show support. Although participant’s family had absence of mental health in their conversation, it became an important topic once someone had a mental health issue brought upon them.

“A particular person of mine who had really bad mental health, it brought a point in our family that it’s important... it slowly was bringing part of my family together, but it’s still not spoken enough like maybe from another family they might speak about mental health more casually. Whereas in my family it’s not spoken but it’s still growing to that part.” (Quinn)

Saving Face

Some of the participants expressed concerns on the usage of mental health resources due to the views it might portray on them. Participants have described hesitation in seeking support because they come from a culture in which they are not accustomed to asking for help. This type of hesitation is a factor in how participants describe their own individual experiences of reluctance to ask for help and fear of being portrayed differently.

“You just feel kind of like, vulnerable in a position to like to have to share with like a stranger... the idea of asking for help I think is something that I struggle with. And I think that’s part of like the culture I grew up with is usually you’re able to figure it out on your own.” (Alex)

The feeling of vulnerability is an outcome of the participants’ attempt to prevent feelings of embarrassment. One participant explained how coming from a tight-knit community where everyone knows everyone made it increasingly difficult to look for mental health resources. The participants felt hesitant because everyone knows everyone’s business and that would make them feel less likely to seek out resources due to stigma and fear of being portrayed differently. The outcome would create negative experiences by bringing shame into the family and therefore being labeled or judged for seeking mental health resources.

“There might have been hesitation to reach out because everybody kind of knew everybody’s business. So, there was an aspect of hesitation in that sense.” (Cameron)

A participant stated that they are accustomed to working hard and self-supporting themselves. They mentioned their distinctive work ethic and lack of support in resolving issues, which hindered their ability to seek help. The participants' experiences reflected their own in terms of culture, customs, and belief systems. They expressed a desire to seek assistance while experiencing overwhelming distress but felt hesitant about opening-up and appearing vulnerable. This crucial aspect exemplified the concept of saving face by shielding oneself from unwarranted emotions like embarrassment or fear, suggesting a reluctance to be stigmatized or develop a poor reputation for seeking mental health resources.

Barriers

A barrier presents complexities in how an individual accesses mental health resources. These barriers may include language, cultural, religious, and other forms of barriers. Participants discussed the significance of language as a crucial tool, but also acknowledged that it may be an overwhelming factor when trying to access resources. They have conveyed the idea that language carries various connotations, and that communicating in their native language does not

always accurately translate into English. Additionally, they expressed that it is more convenient and familiar to consult a doctor who primarily speaks in their language. Participants have expressed a preference for visiting areas that are predominant to their ethnicity and culture as they feel more comfortable speaking the same language.

“Mainly my family went to doctors or hospitals that mainly spoke their language because maybe they feel more comfortable having doctors who speak their language. So, they would not go to a doctor who only speaks primarily English. So, they would drive to locations that are predominantly Asian... I speak Chinese because my family speaks Chinese, so then they would go to those areas.” (Quinn)

A participant expressed personal barriers in which family believed their sexual orientation was a problem, but the participant sought it as a core identity. In turn, the participant’s sexual orientation was used as a manner to search for mental health resources because of the family’s perception that there was something wrong with them. Even though the participants encountered familial barriers, they identified with others who may be experiencing similar challenges and are open to providing resources to help them feel comfortable.

“Typically, there’s people that maybe I relate to, or I feel like are having this same struggle as me. I have these resources that help me feel comfortable” (Avery)

Participants have shared distinct aspects about campus resources from their experiences that factor in barriers trying to access on-campus mental health resources. Participants explained how there is a large student population and few amounts of therapists resulting in lack of sustainability. Simultaneously, participants expressed concerns that therapists might not have the capabilities of handling the various struggles a student might approach them with. Participants explained how on-campus therapy is only short-term, while this might help alleviate some

concerns. Participants described that it would be ideal for it to be long-term articulating that there are circumstances a person encountering a demanding situation might need more therapeutic sessions. Many participants have said that there needs to be more accessibility by promoting on-campus resources through flyers, events, and social media. They mentioned how they would walk around campus and not see any flyer about mental health resources. Participants gave numerous accounts about lack of funding affecting therapists and students alike by having longer waiting periods to finally be consulted.

“I can just walk around this whole campus and there’s no posters or flyers... sometimes even when I’m looking for stuff on the website, I have to go to different tabs and different sections and I feel like probably if you want to go talk to someone for mental health, it’s within those sections so it’s buried deep online.” (Taylor)

“Not knowing what resources are available to me. I reached out to CAPS but at the time, I think since a lot of students are also experiencing a lot of difficulty navigating their mental health issues or problems, I was put on a wait list, unfortunately I was never off that wait list. I was on that wait list from September 2021, and they reach out to me February 2022.” (Jordan)

A distinct barrier a participant mentioned was immigrating to a new country, where there is this set system in place that are different to one’s country of origin. They spoke about how the American healthcare, politics, and bureaucracy is vastly different. The navigation of healthcare was a challenging barrier to overcome since they came from a country that does not have universal healthcare. Although healthcare is universal in the U.S., they found that healthcare in their country was more affordable than in the U.S. by comparing a consultation or a session with a therapist is expensive in the United States but back home it would around a hundred dollars.

“When we first got here, I was 16 years old, and I didn't know about like American healthcare, politics and bureaucracy and stuff like that. And while language barrier was not an issue for me, it was definitely an issue for my parents, who can speak like conversational English, but they're not very familiar with written English or even like the lingo that's used in all those documents. So, when we first got here, it's because we didn't know about insurance. The stuff like bureaucratic stuff, like how do I say it? Like that's a barrier because we came from a country that doesn't have universal healthcare, but healthcare is way more affordable than it is in the US where like maybe here a session with a therapist or just a consultation can cost upward of like a hundred dollars back home” (Jordan)

Cultural Relevance

Participants emphasized the importance of having access to culturally relevant resources that specifically address their unique experiences. They stressed the importance of recognizing these experiences, as they influence their willingness to seek mental health services. The participants generally agreed that there is a lack of professionals who can effectively tailor mental health support to meet the different cultural demands of individuals. An example mentioned by a participant is the absence of alignment in attitudes among therapists and culturally diverse patients, resulting in an inability to establish a rapport with the participant's family. The participant's mother perceived her diagnosis of OCD as an inherent aspect of her personality rather than a clinical diagnosis, and the therapist failed to acknowledge it as such. The absence of cultural and attitudinal alignment resulted in the family experiencing a sense of being misunderstood. Consequently, this resulted in the family not only refusing to continue their treatment, but also intensifying the negative perception and stigma associated with seeking assistance.

“I also think, rather than just an approach, it's also a matter of like attitude. So, by labeling her and by labeling that type of behavior as OCD, it actually makes her feel like, I don't want to look out for mental health because it's not a mental health like disorder. (Jordan)

Other participants also stressed the significance of recognizing the existence of subcategories within cultures, religions, sexual identity, generational status, and others. An essential aspect of cultural relevance is recognizing the intersecting identities of individuals and understanding how each identity can have both positive and negative effects on them. Participants asserted that therapists should prioritize the importance of clients' cultural beliefs and acknowledge the complexity involved in interpreting language. According to their perspective, accessing resources for mental health might be daunting due to the overlapping factors influencing their help-seeking behaviors. However, it is very unmotivating when a person finds the courage to ask for help only to encounter a therapist who lacks cultural competence. Consequently, the absence of expected cultural relevance poses a challenge for individuals in accessing support, thus altering their help-seeking behaviors and utilization patterns.

“I would say it's to try and cater to what is on campus. So maybe people who are of a particular ethnic background, a particular religion, kind of inclination to certain types of music. Just kind of seeing the different types of things that people latch onto or like different identifiers for those people.” (Cameron)

“I think to get them trained a little bit better for all kinds of different situations. Like, I don't think they are equipped to handle all the struggles that students might come to them with and I think just being aware that we're not just Latino or like just Asian. Like there's subcategories too and educating yourself on those things I think is important, but also having

mental health workers from those backgrounds working in the field is probably the most effective way of representation.” (Avery)

Stigma

During interviews, participants shared their perspectives on mental health, their utilization of mental health services, and their experiences with stigma. Participants expressed feelings of uneasiness, vulnerability, and a fear of being looked down upon when seeking mental health resources. A crucial factor is that certain people experience internal stigma as a result of the intersection between their cultural and family beliefs and their own perceptions. This is a result of not having open communication with family, reduced exposure, and having a background where mental health was not acknowledged. Family plays a crucial part in shaping an individual’s experience of mental health stigma, as it is influenced by their personal viewpoints. Participants expressed their belief that therapy is typically utilized as a last resort when one reaches a state of extreme severity and has exhausted all other alternatives.

“I usually viewed therapy like if it was severe, like if I’m experiencing it all the time, I think I never really... I think I’m still trying to unlearn that.” (Alex)

For example, social stigma impacts participants' access to mental health resources due to the perception of being labeled “crazy”. Some individuals emphasized that being part of a high-achieving culture has led to a lower attention to mental well-being, since the focus has mostly been on academic success. This can result in feelings of guilt due to the impact on someone’s academic performance, which in turn disrupts the culture of achievement. Participants reported engaging in conversations with friends or others rather than their family members due to the fear of being stigmatized, as they shared similar emotions. A participant provided an example of how mental health is viewed in their culture wherein the individual's parents attributed their mental

disorder to external factors. Another participant, drawing from their own cultural perspective, asserted that individuals are personally responsible for mental diseases as a result of the decisions they have made.

“Growing up... back home in Indonesia, people would say autism is literally your parent’s fault. Like, they did something wrong, maybe it was during their pregnancy or before that it’s a health or a lifestyle issue.” (Jordan)

“Issues such as schizophrenia, for example, in Indonesia... during my parent’s time, they don’t think of schizophrenia as like a mental disorder. It’s more like she just went crazy and crazy is not a mental health issue. It’s like there’s something broken within your soul that can’t be fixed.” (Jordan)

A couple of participants depicted the involvement of family with mental health reduced stigma and bridged the gap in seeking mental health resources. Examining the different generational status has shown that the second or third generation experience fewer stigma than their first-generation counterparts due to the openness and ease of speaking to family about it. Consequently, depending on the major, for instance participants who majored in psychology were more likely to seek out mental health resources due to the environment they are exposed to and recurring topics during classes. They described the likeliness of speaking to family about them and informing them about the seriousness of mental health despite coming from a culture rooted in stigma.

“I feel like because my mom was always in the mental health field, so it’s always been a discussion and I think I got lucky with that. Since I know for her, like when she talks about it, her family wasn’t like too big on getting help and things like that.” (Casey)

Model Minority Myth

Several participants emphasized the significant influence of academics inside the family setting. When asked about their understanding of mental health, multiple participants associated it with academics and the capacity to effectively handle academic responsibilities. This is representative of a cultural environment that places importance on achievement and showcases how the Model Minority stereotype impacts perspectives on mental well-being. When asked about the significance of family support, a participant acknowledged that their family's support had a key role in attaining success in life. They clarified that their family was supportive due to them wanting for both them and their siblings to succeed. This is an example of a positive viewpoint when evaluating the impact of the model. Thus, considering the perspective on the relationship between academics and mental health, it is typical to prioritize seeking out resources that support academic success rather than relying on mental health services.

“They're more on the positive side. They definitely do want to see me and my siblings or whoever, do well and succeed in life. So, they'll always be there.” (Taylor)

“I think something that's culturally relevant is that we came from a culture of achievement. So, when my parents think of mental health resources that are geared more towards academic performance, they're very, very open to that.” (Jordan)

While the model minority myth may be perceived as positive in some instances, it can create stress for those who always strive to meet the expectations associated with this model. One participant, who referred to themselves as a high achiever, admitted to placing significant pressure on themselves. Ultimately, the participant acknowledged giving higher priority to their academics than their mental well-being. They attributed this mindset to their upbringing, which instilled in them the values of diligence and self-reliance, rather than relying on others for help. This corresponds with the model minority myth, which establishes the expectation of being

hardworking, academically talented, and ultimately successful in one's professional and economic pursuits. Additionally, there was reference to the social disapproval associated with obtaining mental health support, while being accepting of requesting assistance for academic achievement. They conveyed that their family was receptive to accepting assistance and recommendations for enhancing academic achievement, while regarding mental health concerns as temporary feelings of sadness that would eventually subside.

“It's like, oh my god, yeah, all my kids have ADHD. How do you like, perform better in school because of that? And they're very open to feedback and help about that. But when it comes to depression for example, or anxiety, they're like, oh, they're just experiencing these like blues. They'll get over it. Like think that's an approach that they have.” (Jordan)

“Usually, I think I was taught to like, keep pushing forward and like not hold everything in, but life is not going to be given to you. You have to work for what you want and like, stuff like that. So, I think somehow like that kind of influenced me as well” (Alex)

“More to my mental health background is usually influenced by the workload and like how much pressure I put on myself. Yeah, because usually, I would say I'm a pretty high achieving person and I'm very passionate about stuff I do. So usually, I like to put my full heart into things and like, I'm not a half and half out person. So, I think to a certain extent mental health becomes on the backburner” (Alex)

Resources

Many participants emphasized the need for mental health resources that provide tailored support to cater to the varied needs of individuals. A participant highlighted the need for mental health resources, such as therapists or specialists, who have a deep understanding of the challenges faced by students, especially the specific hardships encountered by first-generation

students. Nevertheless, there are noticeable distinctions among the different generational statuses when it comes to what they consider resources such as pursuing hobbies, talking with friends, or participating in physical activity. First-generation participants regarded resources as including activities such as practicing religion, engaging in conversations with others, and seeking therapy. A participant highlighted the nuances and distinctions among the various groups among Asian and Latinx ethnicities. To successfully address the complex aspects affecting individuals' need for accessing mental health resources, it is important to evaluate the several subcategories involved.

“Find therapists who specialize in those areas and bring them in if possible... have people who are very adequate dealing with those specific demographics. Like if you have troubled teens, bring someone who's experienced with troubled teens. If you have people who are, who are more experienced with, African Americans. Bring someone who's more experience with African Americans. So, I guess almost catering to the specific demographic.” (Riley)

The participants highlighted the significance of culture and religion as a crucial factor when seeking mental health resources. The shared cultural values or religious beliefs between individuals participating in therapeutic sessions foster a sense of trust and increase the likelihood of their willingness to seek help. A common concern among the participants was the significance of catering to their diverse backgrounds, with a focus on understanding language as a necessary requirement when looking for mental health resources. Given the participants' assertion that language is subject to varying interpretations, it is imperative to have a greater number of therapists or experts who possess the ability to understand and interpret individuals' definitions when communicating with diverse individuals.

“It is really important for language. It’s easier for like someone to just communicate what they’re going through. I think if they’re trying to articulate what they’re feeling in a language that they’re not comfortable with, I think it’s very difficult. And I think that is very important to have that openness...even for me, if I were to have a Korean Christian therapist, I would feel like even a cultural connection” (Alex)

Religion

A recurring topic discussed in multiple interviews was the dual influence of religion, which encompasses both positive and negative aspects. A participant conveyed her dissatisfaction with her family's initial approach to mental health resources, which involved engaging a Christian conversion therapist to assist her in addressing her sexual identity. A different participant stated that, due to their attendance at a Catholic school, it was common to speak with a priest regarding any worries or issues. Nevertheless, openly communicating with a priest was not always easy or comfortable, which consequently posed a hindrance and negatively influenced their help seeking behaviors. Furthermore, it was common for families to search for religion and prayer as their own method of utilizing as a means for mental health.

“The only time they sought out mental health resources was for me, and they sent me to a Christian therapist, like a conversion therapist. So that was the only time that they interacted with it and that was my first time. It didn't go well.” (Avery)

“I think like the cultural and religious beliefs made it hard for me to access like adequate mental health when I needed it.” (Avery)

“I know for me growing up in high school and all that, I didn't know about anything in terms of where I could seek help or even at the campus, for me, I went to a Catholic high school, my exposure that was just like I, maybe I could talk to a priest, but that was really it. And like,

sometimes there's things you don't feel like talking to a priest about, because of that you could just keep it to yourself and just drag that along with you until you finally find someone to talk to about.” (Riley)

“If anything, my parents would seek out the church and that was their outlet, thus that became our outlet for a lot of things too.” (Riley)

Some participants approached the topic of religion from a more positive perspective, particularly those who strongly associated with their religious beliefs. The participants emphasized the importance of making resources in therapy more culturally appropriate and inclusive of religion and spirituality. A participant expressed that while their family suggested seeking guidance from a church friend for any issues that might arise, they would be more open to seeking out mental health approaches that not only aligned with their religious beliefs but also respected their Korean culture. All participants who strongly associated with their beliefs emphasized that their families would be more receptive to obtaining mental health resources if there was a religious aspect involved.

“I grew up Christian pretty much my whole life, so I think that's another boundary that stops me from going to therapy because usually my parents would be like, oh, why are you, why are you going to therapy? Or why are you even thinking of going to therapy when you can reach out to like a church friend or something like that.” (Alex)

“So in a sense it was addressed in the way that they knew how to address it. Religion was a big thing and then, you know, other forms, taking care of yourself, spirituality, and those sorts of things.” (Cameron)

“In terms of religion, I also would seek things that kind of compliment what I believe, what I've grown up believing.” (Cameron)

“I guess it might be a little hard, but maybe religion could be part of it. Because most of my family speaks the religion is Buddhism, so maybe that could have, maybe the professional aspect is they're more open to having other religions be spoken of.” (Quinn)

Idioms of Distress

Participants agreed that language is an essential factor to consider. However, it was observed that therapists must also have cultural sensitivity to understand the many idioms of distress that are used to convey mental health issues. A participant emphasized the importance of selecting their language with caution to prevent the stigmatization of their concerns given that mental health problems are stigmatized in their home country. Additionally, there was a reference to the lack of awareness resulting in the loss of translation. An example given was how trauma is defined in Indonesia versus in the United States. Thus, recognizing this distinction could promote a sense of understanding in the patient, as it relates to the familiarity with idioms of distress.

“They don't translate well because while like OCD could be recognized as like a clinical issue here, my mom who has shown symptoms of OCPD, not OCD, who has been referred by her primary care physician to see a specialist, she doesn't see it as a disorder, but a quirk she has.” (Jordan)

“Like, were able to say like, no, that's not what they meant, ma like, they meant it this way. Think of it this way. And she's like, oh, okay. Then they should have said it that way” (Jordan)

“From a language, like a linguistic perspective or like a process perspective. But it makes me think of the soundness of your soul. Like it makes you feel like I'm at peace and that's when I feel like I'm mentally healthy.” (Jordan)

“I think of that as like, that's just your character. So, growing up I kind of viewed mental health that way. Like it's not, how do I say it? It's not an issue, it's more like that's your character type of thing.” (Jordan)

“I would think of my mom getting cancer as a traumatic event rather than just a stressful event. Because like for me, while I understand that it's stressful, it's also traumatic... or she would have to live without certain types of autonomy over her own body. And like, I think I thought that would make her more likely relate to the trauma side rather than the stressful.” (Jordan)

“Not trauma, not traumatized, but that's also maybe because like culturally trauma and Indonesia is like for example having families torn apart or like losing family to like a natural disaster. That's traumatic.” (Jordan)

Discussion

There is a growing interest in developing programs designed to increase help-seeking behaviors among college students of Asian American and Latinx backgrounds. Furthermore, there is a lack of research examining the similarities between these two groups and the factors that influence their utilization patterns. This qualitative study aims to bridge the gap in research using a cross-cultural approach by exploring the experiences and patterns of mental health utilization among college students. The study expands on previous research that primarily examines the effects of stigma and barriers on mental health, while also considering the influence of cultural linguistics within a therapeutic context. Among Asian American and Latinx college students, the presence of intersectionality and diverse perspectives revealed common patterns regarding the utilization of mental health services.

The study suggests that family influences play a role in shaping the help-seeking behaviors of Asian American and Latinx college students. These influences can either provide a support system or hinder their willingness to seek mental health resources. Simultaneously, stigma is a significant problem that participants acknowledge having experienced social stigma, cultural stigma, and a lack of discourse regarding mental health. The participants indicated that stigma is a factor contributing to the underutilization of mental health services as it exposes them to vulnerability, leading to feelings of shame and unwarranted attention towards them. The participants described their parents' experiences of immigrating from different countries, having established cultural beliefs wherein mental health was not acknowledged and individuals with mental illnesses were labeled as "crazy". Notably, the participants expressed those cultural beliefs and customs evolved into internalized stigma, influencing their perception of mental health. However, participants who were open to engage in discussions about mental health with their family members were able to eliminate any preconceived stigma and modify their patterns of seeking help, thereby enhancing their motivation to access mental health resources.

The application of thematic analysis revealed the emergence of nine primary themes concerning the impact of mental health resources on college students of Asian American and Latinx backgrounds. The nine themes highlight the significant viewpoints regarding disparities that the participants experience. Family engagement and support are salient, which could increase the likelihood of enhancing the participants' help-seeking behaviors with mental health. Concurrently, family members may hinder and create barriers for an individual in their search for resources, leading to experiences that are stigmatizing. The impact of saving face is evident in cultural norms that prioritize avoiding embarrassment by refraining from seeking assistance, as it may tarnish their reputation. Participants identified various barriers that have affected them,

including cultural, religious, assimilation stress, and language. These factors serve as identifiers that need to be recognized and addressed when individuals are seeking mental health resources. Regarding cultural relevance, participants stressed the lack of professionals capable of effectively tailoring mental health support to address the diverse needs of individuals and their perceptions of mental health. Participants were concerned about how others would perceive them and feared being stigmatized. This fear led to a decrease in their willingness to seek help for mental health issues, as disclosing such concerns was frowned upon. Some participants discussed how they come from a culture that values achievement and embraces the model minority stereotypes, which emphasizes achieving success and placing significance on academic achievements. In contrast, participants recognized that the pursuit of success exerts significant pressure on mental well-being, resulting in the neglect of mental health.

By examining the intersection of factors such as resources, religion, and idioms of distress, it is possible to identify the intersectionality of Asian American and Latinx college students. This understanding can be used to customize mental health resources to meet the unique needs of everyone. Religion was a frequently mentioned topic throughout the interviews, and participants discussed the importance of intertwining mental health resources with religion and spirituality to strengthen the connection between the individual and therapists. The findings of idioms of distress highlight the importance of recognizing cultural differences in the interpretation of mental health topics. This highlights the necessity for therapists to demonstrate cultural sensitivity to effectively comprehend and convey an individual's mental health concerns, as well as understand the nuances of language usage.

Additionally, beyond the findings, four unexpected themes emerged: the importance of attitude alignment, the intersectionality of mental health perceptions, the interplay between

individual identity and generational context, and the challenges in prioritizing mental health among academic overloads. Attitude alignment highlights the importance of attitude in culturally diverse individuals, such as those with a mental illness who may not view it as a mental illness, but rather as a personal characteristic or trait. Failure to be recognized by the therapist leads to an inability to build a connection with the individual and influencing their help-seeking behaviors, thereby severing the trust between the individual and the therapist. Culturally sensitive approaches enable the improvement of attitude alignment by addressing the reluctance to discuss symptoms through efficient communication between the individual, family, and mental health professional. Each participant provided diverse perspectives on mental health, but they also highlighted the complex mental health inequalities that impact them at both the individual and societal levels. By acknowledging and comprehending their intersecting identities, it fosters an inclusive and empathetic approach to mental health.

During the interviews, participants identified themselves as being part of either the first, second, or third generation. Every individual encountered distinct challenges and had unique experiences that shaped their identities. Therapists need to consider both the individual's identity and the generational context, as well as the social and cultural changes that influence the complexity of the individual's perception of mental health, even if they are from different generations. Given the importance of academics for Asian American and Latinx college students, the substantial amount of work they must complete can result in stress, anxiety, and burnout, which in turn negatively impacts their mental well-being during midterms and finals.

Furthermore, depending on the major, some students may experience a lack of support networks and may face social disapproval when attempting to address mental health concerns. On-campus mental health resources must recognize the impact of mental health on performance and create

supportive environments for students by prioritizing mental well-being across campuses and fostering awareness to create safe spaces for students to seek help.

Limitations

There were a few limitations that were primarily associated with the timeframe. To meet the deadline for the study, data was gathered from a limited sample size. Therefore, the findings may not be generalized to the broader demographic of Asian American and Latinx college students. In addition, the Latinx sample was predominantly composed of individuals who identified as Mexican, resulting in a lack of diversity representation. Future research should incorporate data obtained from a larger sample size to account for a wider range of diversity and thus yield more generalizable findings.

Future Implications

Future research should investigate the impact of generational status on help-seeking behaviors and utilization patterns, considering the unexpected themes and significant variations in responses and experiences among participants. The findings indicate that individuals from the first generation showed greater resilience, leading to a higher level of reluctance in seeking assistance and resolving their own challenges. In addition, second generation participants utilized distinctive terminology to articulate their understanding of mental health, diverging from the standard clinical definition. Moreover, both groups consistently emphasized the integration of religion and spirituality, highlighting the need to explore this aspect in relation to help-seeking behaviors and utilization of mental health resources.

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Cross-Electrophile Coupling of Oxetanes and Latinx American College Students

Cross-Electrophile Coupling of Oxetanes

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ABSTRACT:

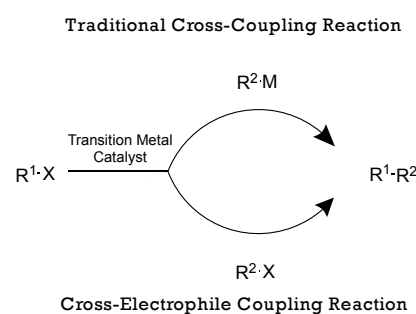
Cross-electrophile coupling reactions are important for the formation of complex organic molecules. Here we report the development of a nickel-catalyzed cross-electrophile coupling reaction between oxetanes and aryl halides. This method includes the opening of the oxetane ring and the formation of new carbon-carbon bonds between the electrophile coupling partner and the oxetane ring. Oxetanes are crucial as they have high ring strain that allows for the ring to be susceptible to being opened. The use of a nickel catalyst is a better alternative than other precious metal catalysts due to its carbon footprint and abundance. The specific oxetane that is being formed is important as it is a model substrate for the development of the cross-electrophile coupling reactions that are being investigated.

INTRODUCTION:

Organic synthesis is a field that scientists have been able to use for centuries. With such a process, we can attempt to replicate molecules that we observe in nature or even modify them to create new molecules. Due to organic synthesis, we are able to synthesis useful products that can go from pharmaceuticals to aid against illness to high-technology materials that can be used for phones and computers.¹

Cross-coupling (XC) reactions have helped advance organic synthesis for the better and allowed more ways to form C-C bonds for complex molecule. These reactions requires a transition metal catalyst to

Scheme 1: Cross-Coupling Reaction vs Cross-Electrophile Coupling

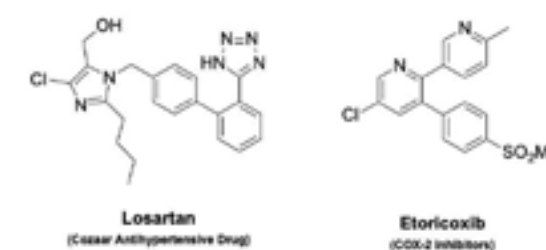


facilitate the reaction. The catalysts that have been found and used are palladium and nickel.² The issue behind using palladium, although it works well, is the carbon footprint that is left behind to obtain the metal as well as the cost and toxicity. Nickel is an abundant metal and is much more cost friendly. Here we are trying to create a new reaction that includes a variant of cross-coupling known as cross-electrophile coupling (XEC), which involves the usage of two electrophile rather than a singular one. **Scheme 1** shows the general

reactions of the two cross-coupling reactions. The downside to cross-electrophile coupling is that due to their similar reactivity, the challenge of selectivity forming the cross-coupled product is present. The selectivity of the product, whether the electrophile reacts with itself during the XEC or the other

electrophile. This issue is not present in the traditional cross-coupling reactions as they have one electrophile and one nucleophile that have different reactivities.³ Losartan and Etoricoxib are examples of commonly prescribed drugs that are made from cross-coupling reactions (**Figure 1**).⁴

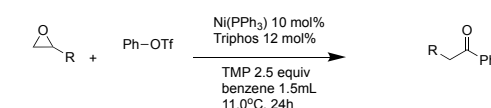
Figure 1. Synthesized Drugs from Cross-Coupling Reactions



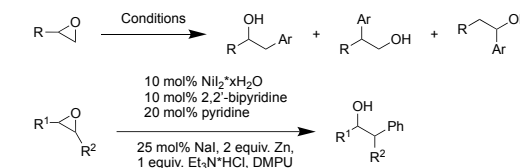
Epoxides, which are highly strained three membered cyclic ethers, have been utilized in cross-coupling reactions to form other complex compounds. Rong and coworkers were able to synthesize aryl ketones by conducting nickel catalyzed cross-coupling reactions between epoxides and aryltriflates (**Scheme 2a**).

Scheme 2. Examples of Cross Coupling Reactions with Epoxides

Rong 2022:

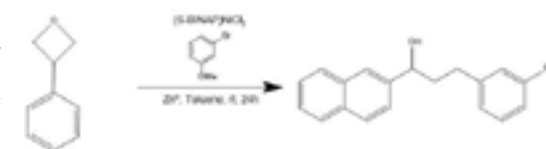


Weix 2014:



work similarly within a cross-coupling reaction. We are developing a nickel catalyzed XEC reaction of oxetanes with various aryl halide coupling partners to create a new reaction to form new C-C bonds to form new complex molecules (**Scheme 3**).

Scheme 3: Cross-Electrophile Coupling Reaction

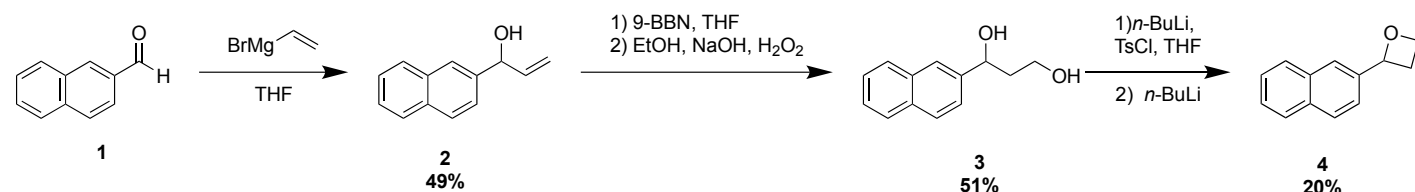


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1. Experimental Procedure
 - a. Materials:

All chemicals and solvents used were purchased from ThermoFisher Scientific. All glass wear was purchased from Chemglass and Synthware. A Varian 400 MHz NMR Machine used was used to collect ^1H NMR data in the Department of Chemistry and Biochemistry at California Polytechnic University, Pomona. Rotary Evaporator was purchased from Buchi. Analytical Balances were given by Dr. Stieber of the Department of Chemistry and Biochemistry at CPP. Stir plates were purchased from Corning.



b. The Grignard Addition of Vinylmagnesium Bromide to Naphthaldehyde

1-(naphthalen-2-yl)prop-2-en-1-ol (2) was synthesized using a modified procedure reported by Jarvo.⁶ To a flame-dried round bottom flask equipped with a stir bar, Vinylmagnesium (6.0 mL, 1.1 equiv) was added and cooled to 0°C. 2-naphthaldehyde (4) (0.63g, 1.0 equiv) was dissolved in anhydrous THF (4 mL). The solution was added to the round bottom reaction flask dropwise and allowed to stir for _ hour. NH_4Cl (10 mL) was added to quench reaction. Product was then extracted with EtOAc (3 x 20 mL) in which the organic later was collected and dried with Na_2SO_4 and concentrated under vacuum. The residue was purified by column chromatography (0-50% EtOAc/Hexanes) to produce the title compound as a clear liquid (0.36g, 49.25%). Analytical data is consistent with literature review.⁶ ^1H NMR: (CDCl_3) δ 7.84 (td, J = 7.6 Hz, 5H), 7.48 (dq, J = 6.1, 3.6 Hz, 4H), 6.13 (ddd J = 5.4, 4.7, 6.2 Hz, 1H), 5.41 (dq, J = 1.6, 1.2 Hz, 3H), 5.25 (dt, J = 1.2 Hz, 1H), 4.12 (q, J = 7.1 Hz, 1H), 2.04 (s, J = 2.0Hz, 1H), 1.57 (d, J = 9.2 Hz, 2H), 1.26 (t, J = 7.2 Hz, 2H).

c. Hydroboration Oxidation of Enol to Diol

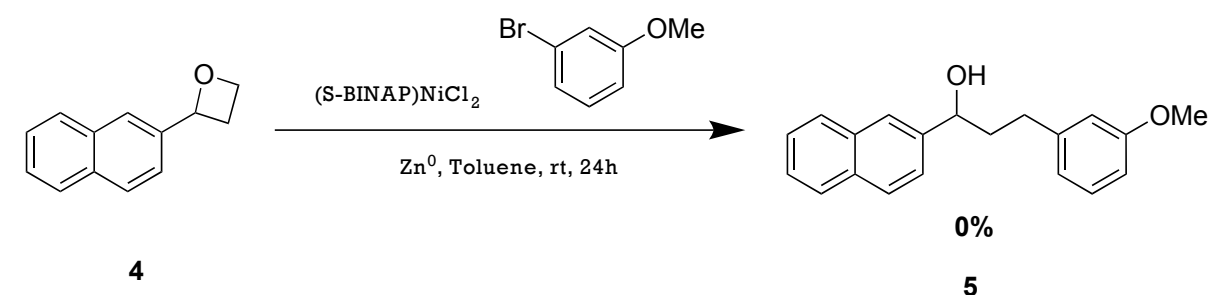
1-(naphthalen-2-yl)propane-1,3-diol (3) was created using a modified procedure reported by Bull.⁵ To a round bottom flask with a stir bar, 1-(naphthalen-2-yl)prop-2-en-1-ol (0.36 g, 2.0 mmol, 1.0 equiv) was added and dissolved with anhydrous THF (5.0 mL, 0.4 M). The round bottom flask was then cooled to 0°C. 9-BBN (9.9 mL, 5.0 mmol, 2.5 equiv) was added to the reaction flask slowly. The reaction was brought to room temp and stirred overnight. EtOH (5.9 mL, 3mL/ mmol), H_2O_2 (2.0 mL, 1mL/ mmol), NaOH (2.0 mL, 1mL/ mmol) were added in this exact order and stirred for 3 hours. The reaction was quenched with H_2O (10 mL). The product was then extracted with EtOAc (3 x 35 mL), the organic layer was collected and dried with Na_2SO_4 . The residue was purified by column chromatography (0-50% EtOAc/Hexanes) to produce the title compound as a white solid (0.20 g, 50.5%). Analytical data is consistent with literature values.⁵ ^1H NMR: (CDCl_3) δ 7.84 (m, 5.1, 8.2 Hz, 4H), 7.48 (m, 3.5, 5.8, 9.4 Hz, 3H), 5.15 (dd, 3.7 Hz, 1H 2H), 3.91 (t, 5.3 Hz, 2H), 2.09 (m, 2.3, 2.6, 3.4, 4.7, 6.4, 6.6 Hz, 3H)

d. In Situ Tosylation/ Intramolecular Nucleophilic Substitution

2-(naphthalen-2-yl)oxetane (4) was attempted to be synthesized using a modified procedure reported by Loy.⁷ To a round bottom flask, 1-naphthalen-2-yl)propane-1,3-diol (0.10 g, 0.50 mmol,

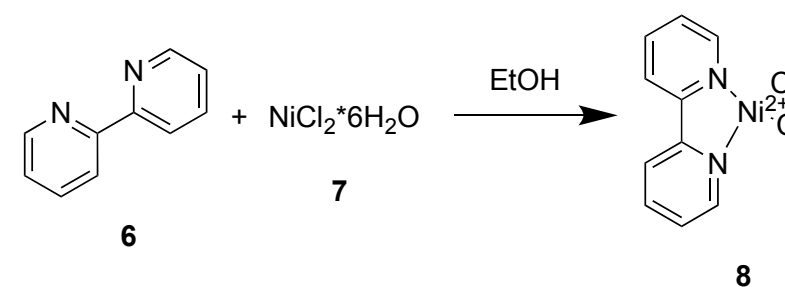
1 equiv) was added and dissolved in anhydrous THF (2.5 mL, 4.0 M). To the reaction flask, *n*-BuLi (**0.2 mL**, 0.5 mmol, 2.5M) was added and stirred for 30 minutes at 0°C. P-toluenesulfonyl chloride (0.10 g, 0.5 mmol, 1 equiv) was dissolved in anhydrous THF (2.5 mL, 4.0 M) and was then added to the reaction flaks and was stirred for 1 hour. Another round of *n*-BuLi (**0.2 mL**, 0.5 mmol, 2.5 M) and reaction was stirred overnight. Reaction was diluted with Et_2O (15 mL) and extracted with H_2O (3 x 15 mL). Organic layer was collected and dried with Na_2SO_4 . The product was then purified via column chromatography to produce the title compound as a yellowish oil (0.019 g, 20.3%). Analytical data is consistent with literature values.⁷ ^1H NMR: (CDCl_3) δ 7.86 (m, 9.5, 6.9, 5.1 Hz, 4H), 7.58 (d, 1.5 Hz, 1H), 7.56 (d, 1.7 Hz, 2H), 5.98 (t, 7.4 Hz, 1H), 4.89 (td, 7.4, 6.7 Hz, 1H), 4.74 (td, 5.6, 2.8, 3.7 Hz, 1H), 3.10 (dtd, 5.9, 2.3, 2.8, 2.7, 3.1 Hz, 1H).

e. Cross-Electrophile Coupling of Oxetane from Previous Step with 3-Bromoanisole



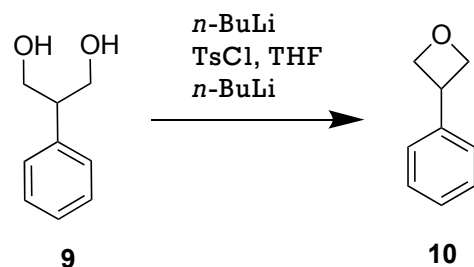
2-(3-methoxyphenyl)-1-(naphthalen-2-yl)ethan-1-ol (5) was synthesized using a modified procedure reported by Hewitt.⁸ To a 8 mL vial equipped with a small stir bar, 2-(naphthalen-2-yl)oxetane (0.0186 g, 0.1 mmol, 1 equiv), (S-BINAP)Nickel Dichloride (0.008 g, 0.0247 mmol, 0.1 equiv), Zinc Dust (0.43 g, 2.0 equiv) and THF (0.5 mL, 0.2 M) was added. Reaction was stirred for 24 h. Afterwards, the reaction was passed through a silica plug in a monster pipet with Et_2O . The eluent was collected in a vial and concentrated in vacuum. Trimethylphenylsilane was added as an internal standard to obtain a ^1H NMR yield. Analytical data was not consistent with known values. ^1H NMR: (CDCl_3) δ 7.86 (s, 2.4 Hz, 1H), 7.82 (s, 8.6 Hz, 3H), 7.51 (s, 9.0 Hz, 3H), 5.31 (s, 9.2 Hz, 1H), 1.42 (s, 3.7 Hz, 1H), 1.24 (s, 9.8 Hz, 3H).

f. Synthesis of Bipyridine Nickel Dichloride Catalyst



(2,2'-Bipyridine)nickel dichloride (6) was synthesized using a modified procedure reported by Singh.⁹ Nickel dichloride hexahydrate (0.15g, 0.64 mmol, 1 equiv) was added to a round bottom

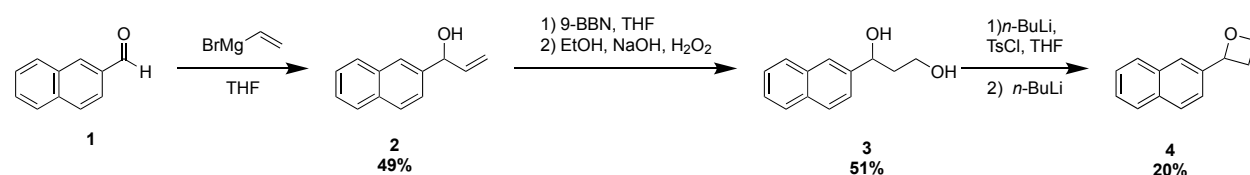
flask, in which it was dissolved in EtOH (2mL). In a different flask, 2-2'bipyridine (0.10 g, 0.64 mmol, 1 equiv) was then dissolved in EtOH (2mL). The solution of 2-2'bipyridine and EtOH was then added to the reaction flask. It was stirred for overnight. The residue was then filtered using a Buchner funnel to which the title product as s seafoam green solid (0.010g, 5%). No analytical data was collected.



g. Alternative Oxetane Formation

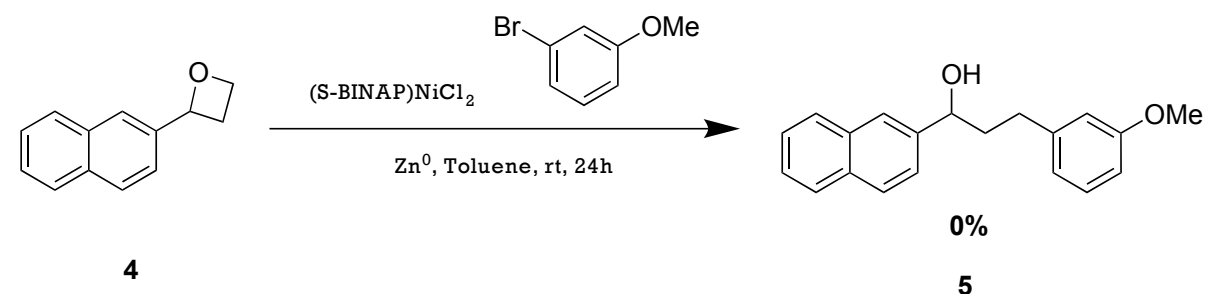
3-phenyloxetane (10) was synthesized using a modified procedure reported by Loy.⁷ To around bottom flask, 2-phenylpropane-1,3-diol (0.61g, 4.0 mmol, 1 equiv) was added and dissolved in anhydrous THF (10 mL, 0.2 M). To the reaction flask, $n\text{-BuLi}$ (1.6 mL, 4.0 mmol, 2.5M) was added and stirred for 30 minutes at 0°C. P-toluenesulfonyl chloride (0.76 g, 4.0 mmol, 1 equiv) was dissolved in anhydrous THF (2.5 mL, 4.0 M) and was then added to the reaction flaks and was stirred for 1 hour. Another round of $n\text{-BuLi}$ (1.6 mL, 4.0 mmol, 2.5 M) and reaction was stirred overnight. Reaction was diluted with Et₂O (25 mL) and extracted with H₂O (3 x 25 mL). Organic layer was collected and dried with Na₂SO₄. The product was then purified via column chromatography to produce the title compound as a yellow oil (___). Analytical data is consistent with literature values.⁷

RESULTS/DISCUSSION:

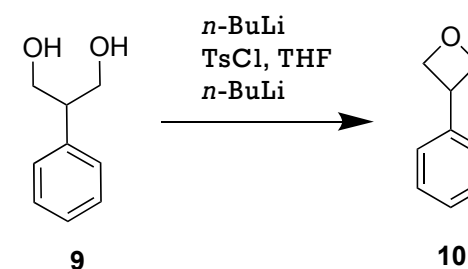


A three-step reaction sequence that was used in an attempt to synthesize **oxetane (4)**. The first step of the sequence is the grignard addition of vinylmagnesium bromide into naphthaldehyde. I conducted two attempts for the this step of the sequence. The first attempt of this reaction had the product form at a 40% yield, however due to the reaction being left to stir for 7 days, it resulted in a reduction of our product into a byproduct. Due to the byproduct that was formed, whose identity was an alcohol, the product was a yellow solid substance. The second attempt of this reaction for the synthesis of 2-(3-methoxyphenyl)-1-(naphthalen-2-yl)ethan-1-ol (**2**) yielded a 49% product formation with little byproduct compared to the first attempt. The product of the second attempt formed a white chalky solid. The second step of this reaction sequence is the hydroboration oxidation to turn an enol into a diol. In this step, the synthesis of **1-(naphthalen-2-yl)propane-1,3-diol (3)** yielded a 50% product formation. The last step of the reaction sequence involved a Tosylation and followed by a intramolecular nucleophilic substitution. This

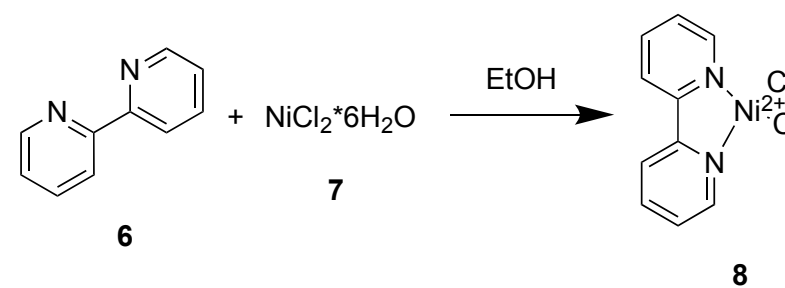
last step of the sequence involved the synthesis of 2-(3-methoxyphenyl)-1-(naphthalen-2-yl)ethan-1-ol yield a 20% product formation. Due to this low yield, we were only able to have 0.1 mmols of our product which severely decreased our ability to undergo the cross-electrophile coupling.



The first attempt at the nickel-catalyzed XEC with oxetane (**4**) was unsuccessful. This was most likely due to the oxetane being more volatile than originally thought. Compounds with a molecular weight of less than 200 g/mol are more volatile than those over 200 g/mol. Due to this, it is suspected that we are losing our oxetane due to it being less volatile. The reaction went to completion and the oxetane (**4**) was formed however it is suspected that it could have been lost while it was on the rotary evaporator or during the work up of the XEC reaction. We did however observe an 86% reagent recovered for the 3-bromoanisole by ¹H NMR.



An alternative synthesis for an **oxetane (10)** was used as the reaction was much quicker as a 1 step synthesis rather than the previous reaction at 3-steps. The product molecule of this reaction was much more volatile than our previous oxetane however with it being able to be synthesized at a much quicker time and bigger mmol scale so the amount lost wouldn't have affected the amount of the oxetane that we could use.



With three trials of the synthesis of Bipyridine Nickel Dichloride, only one was successful even if it yielded a 5% product formation. The successful trial was due to the flame drying of the round bottom flask with the Nickel Dichloride Hexahydrate inside. The reaction started off as a green color that then turned into blue and ended with a seafoam green color. The first failed attempt of the formation of the nickel catalyst started off as a red color that transitioned to reddish purple then to blue purple and ended as a light blue color. The Nickel Dichloride Hexahydrate was flamed dried in this attempt however the mmol scale was off and there was too much of the nickel dichloride hexahydrate. The second failed attempt did not do what was intended as the nickel dichloride was not flame dried.

CONCLUSION:

Overall, the synthesis of oxetane (4) brought up several issues that will need to be resolved before continuing forward, however, the data that was collected about the oxetane and its properties was quite informative. The two cross-electrophile coupling reactions that we analyzed did not work in the way that we had intended, however with the data that has been obtained through our attempts we will hopefully allow us to create the new reaction in the future. We have also only investigated one catalyst for each substrate that was used, but there are many more catalyst systems that remain.

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Mason
Angelina

In the Affective Borderlands: Staff Experiences with Microaggressions in the After-School System

Abstract

Microaggressions are brief and commonplace daily verbal, behavioral, or environmental actions (whether intentional or unintentional) that communicate hostile, derogatory, or negative slights and insults toward members of oppressed or targeted groups (Nadal 2014). While microaggressive acts have the capacity to be present in any area of society, and while researchers have extensively explored the microaggressions within higher education (Franklin 2016) and the K-12 system (Daftary 2023), this study will examine the role and impact of microaggressions in the after-school K-12 system, a highly under-researched application (Steketee 2021). This study is an investigation into how microaggressions regulate the cultural norms of the after-school environment as well as affect the bodyminds of the adult line staff that work there. Bodyminds is a term from Disability Studies that this study will employ; bodymind suggests that our minds and our bodies, rather than being separate entities, inform one another and are critical if we are to have a holistic and complete understanding of a person’s experience (Price 2015; Schalk 2018).

Introduction

As someone who has been a member of the after-school program system for 12 years of my life, and worked at one for two years, I became aware of the ways in which the staff members were emotionally taxed. By the end of the day, feet were dragging, the default activity was freetime, and exhausted smiles were plastered to faces for parents picking up their kids. The thought of meetings with administration present or having annual performance checks invoked such widespread anxiety that close bonds were formed due to shared feelings. There are obvious sources of emotional taxation, such as the demands of working with children as a part of the K-12 system, but there are also sources that are not discussed as publicly. This research centers those sources that are spoken about in hushed voices during 10-minute breaks and expressed in frustration among close friends in the parking lot.

The unchecked manifestation of microaggressions within these educational spaces emotionally tax the workers on top of all the other unpaid, expected labor that being a line staff in an after-school program demands. For the sake of this study, Kevin Nadal’s definition of microaggressions will be used: “commonplace verbal, behavioral, or environmental actions that communicate hostility toward oppressed or targeted groups” (2014). Besides the inadequate amount of paid preparation time for activities and becoming an educator without enough training, microaggressions manifested during interactions with other program affiliates chip away at the emotional and mental security of the staff they are directed toward. These interactions are specifically those that occur between staff to staff, staff to higher administration, and staff to members (children). In my research I will be referring to these staff members as educators, because that is what I believe they are and should be recognized as.

The microaggressions these educators encounter are not due to just one aspect of their identities, and for that reason I am exploring intersectional microaggressions. Even though I am examining topics of racism, sexism, homophobia, ageism, etc., there will be a primary focus on racism and sexism due to the large number of people of color and women/femme-identifying people who work in these roles as educators/line staff. Being able to define these harmful manifestations of systemic oppression and educate people on possible ways of responding to them is important in preserving the well-being of educators across the field. Unchecked microaggressions will alter the lived realities of educators and increasingly strain the body and minds of these professionals over time. This can lead to a heightened sense of uncertainty, imposter syndrome, and hyper-vigilance.

Consequently, this will likely negatively affect the experiences of the children who attend these programs when they deserve to be in a space that is safe for their social development. My research seeks to add to the fields of Gender and Ethnic Studies by examining the impacts of microaggressions on line staff in an under-researched educational space. My primary and secondary research questions ask: 1) Centering the experiences of line staff at afterschool programs how do microaggressions regulate the cultural norms of the space as well as affect the bodyminds of the staff? 2) What are the consequences of unaddressed, and even encouraged, microaggressions that take place within the after-school space amongst adult staff members? Through the lens of confronting intersectional microaggressions and learning how to employ microresistance tactics, I seek to educate people on possible ways of responding to microaggressions and providing a space of witnessing for those unearthing their experiences.

Literature Review

Cummins and Huber discuss the concepts of unpaid emotional labor, critical communication pedagogy (CCP), and microresistance within the realm of academia in their paper “Documenting Emotional Labor.” They build off of previously established definitions of emotional labor from other scholars in order to analyze the different levels of expectations imposed onto professors of different identities, focusing on the demands of women professors to be more like a mother than a mentor. The framework of CCP is used to develop ways to approach the concept of emotional labor and what it means to utilize this labor in a transformative way. CCP is an important concept that I wish to use to analyze my data because it “reveals how everyday productions of language undo, deconstruct, and change educational spaces and realities” (Cummins and Huber 190). It will be used to facilitate dialogue about microresistance against microaggressions that uphold oppressive systems and also change educational spaces and realities, but in a harmful way.

Within this piece of work the authors engage in microresistance by offering autoethnographic narratives to document emotional labor and draws on the personal to make sense of how individual experiences reveal larger structural conditions and constraints (Cummins and Huber 192). I will be engaging in a similar act by gathering testimonios to identify the way microaggressions manifest within after-school systems. The authors do a great job of acknowledging the privilege they have due to being white women in the realm of academia, while also highlighting the amount of emotional work that is expected of women and imposed onto them. Transparency of identity is significant when discussing societal expectations and how they manifest, and is especially necessary in my discussion of intersectional microaggressions.

“A Guide to Responding to Microaggressions” by Kevin Nadal is a short, succinct guide that discusses the type of microaggressions that exist, what type of prejudice the microaggression is coming from, how these experiences affect people, and how to respond to microaggressions. Due to the easily digestible nature of this piece, I used its content when speaking to participants that shared their testimonios with me. Nadal’s definitions gave my participants a larger vocabulary to define and validate their experiences, along with giving them insight on how to address microaggressions in their life and workplace. It is an interactive piece of literature that allows readers to answer a set of questions in order to get the best advice for their specific experience, outlining possible actions the microaggressor could take based on what microresistance tactic the reader chooses to employ, if any. The end of the work responds to the question, “What if I commit a microaggression?” This question gives the reader a safe place to reflect on the fact that everyone has committed microaggressions before due to the biases that we have been socialized to have. It is a gentle call to action to unlearn those problematic phrases and thoughts, and can serve as a starting point for the spread of this information.

“Slight, snub, and slur: leader equity and microaggressions” is a study multiple researchers collaborated on that examines microaggressions within the context of organizational leadership by focusing on interactions between white supervisors and Black subordinates. This piece will provide me with background knowledge on analyzing power dynamics both in job position and race, which are heavily applicable to my study. The participants in this study responded to different scenarios involving these interactions based on whether they were told the supervisor had a history of discrimination or not, and were observed on how the same interactions were perceived based on different behavioral histories. While examining these interactions and how witnesses perceived them, the researchers also investigated the impact of these microaggressions and interactions on work outcomes. Using research on organizational justice and equity theory, it was concluded that “perceiving one’s environment as equitable positively impacts employee satisfaction, commitment, and retention” (Slight 378).

Theoretical Frameworks

To analyze my research, I have four main theoretical frameworks that I will use:

Intersectional Microaggressions, Femme Theory, Affect Theory, and Abject Theory.

Intersectional Microaggressions and Affect Theory are at the heart of my research because they contain concepts that the entire population I’m researching can experience regardless of identity.

Femme Theory is an important addition to my analytical lens due to the fact that educators are predominantly women or femme-identified people and there are set expectations for how they should act due to the dominant patriarchal ideology. Abject Theory is not one that I originally had in mind when creating this project, but decided to utilize it during my data collection process. Someone, or something, that is labeled “abject” disturbs identity, system, and order (Kristeva 1982). Since an aspect of my research is the discussion of microresistance within these microaggressive situations, Abject Theory is useful in analyzing how staff members who engage in these resistance behaviors may be viewed by those in power.

Intersectional Microaggressions combines the frameworks of Intersectionality and Microaggressions—it felt necessary to combine the two into something new because this is the heart of my research. By using this framework, I am intentionally examining microaggressive instances with the purpose of recognizing how the intersecting identities of each individual influence their experiences and emotional responses. In acknowledging how these identities interact with one another, it was an area of interest for me to explore what I categorized as “visual” versus “invisible” identities, and how this affected staff responses to microaggressions between the two types. A visual identity is one that is able to be externally imposed onto a person due to the perception of their physical traits, such as race and gender, while an invisible

one typically cannot be assumed by looks alone (unless stereotypes based on physicality are used), such as education level and class.

Affective/Affect Theory is the critical study of how emotions, feelings, and moods shape behaviors and interactions with the world. By using this theory I will focus on the non-conscious, embodied aspects of affect and emphasize the importance of understanding emotional responses (Seigworth and Gregg 8). Microaggressions will affect the bodyminds of the staff in different ways and have various consequences resulting from being pushed to metabolize the reduction of their identity. I believe that when working with youth, it is especially important to understand one’s emotions and how it shapes internal dialogue and external relationships.

Abject Theory centers a feeling of exclusion, of labeling something or someone as abject if they cause unease and disrupts/disturbs order. Kristeva uses colorful imagery to evoke emotions of disgust and rejection that the abject embodies, likening it to spoiling food and criminals. In the case of this study, I will be extrapolating this theory as it applies to social phenomena: a group that is “necessarily” oppressed to maintain the status quo can cause an abject reaction from those that benefit from their oppression. As a result, this group is labeled as abject because it threatens the stability of those in power. This concept is being applied to line-staff that engage in microresistance tactics within the after-school system in microaggressive incidents, specifically those that involve a microaggressor of a higher power dynamic such as administration.

Femme Theory examines and celebrates femininity—it centers the experiences, identities, and expressions of individuals who identify as femme or embody femininity in diverse ways. This theory is necessary when examining aspects of the education system since the care work required to perform these jobs are heavily feminized, being marked as subordinate and

insignificant. The microaggressions that take place within this industry happen within the context of this connotation, so this theory provides a strong background understanding into the possible stems of certain biases.

As someone who is femme identifying, Femme Theory not only applies to the analysis of my data, but to the conducting of my research and its presentation as well. My research deals directly with the topic of resistance against oppression that occurs in the form of microaggressions, so it is only natural that I engage in my own form of microresistance within the presentation of this project. I began my introduction with a narrative-based approach, making the personal political and pushing back against masculinist norms of subjectivity that value the removal of “self” from analyses (Hoskin 2021).

Methods

This study relies on a mixed methods approach in order to be able to accompany numerical statistics with intentional storytelling. For my qualitative methods, I will be using testimonios. Rooted in Chicana/o Latina/o Studies and an oral tradition, testimonios provide an “intentional and inherently political” space where participants can share narratives that have previously been unspoken (Reyes and Curry Rodriguez 2012). Further, testimonios are used as tools for advocacy and resistance against systemic forms of oppression (Bernal, Burciaga, and Carmona 2012). In particular, scholars have noted that testimonios are also used as an intentional method when examining microaggressions (Oropeza 2014; Perez and Cueva 2012).

Given the lack of documentation about the experiences of line staff at afterschool programs, testimonios will serve as an ideal methodological framework as it will empower my participants to share their stories, providing a space of communal witnessing, validation, and healing (Perez and Cueva 2012). It gives them a political platform to discuss experiences that they may have never discussed previously or even recognized as microaggressions. Because microaggressions impact all line staff and because this study is intersectional in terms of gender, sexuality, race, ethnicity, and age, the only restriction is that participants must have worked for an afterschool program within the last 10 years. I was able to gather testimonios from 5 participants.

For my quantitative method, a survey was created on Google Forms and was open to collecting responses from February to April. An even Likert scale and three open-ended questions were used to assess the participant’s experiences with, and impacts of, microaggressions. The Likert scale is an efficient way to measure this because it will reveal the clear, scaled patterns in the data. To ensure in-depth data and external validity, the survey size

was estimated to 15-25 participants, but I received 14 responses. The questions measured the following: the frequency of microaggressions in the workplace (after-school system), how power dynamics affect the likeliness of responding to a microaggression, and the internal and external consequences of experiencing microaggressive incidents in the workplace. Surveys are ideal given my research’s focus because they offer anonymity/protection, and the quantitative data gathered from them are a way that I am resisting microaggressions toward my own research. Using numbers and statistics pushes against the microinvalidations that happen in academia concerning research that is mainly qualitative (testimonios, in this case).

Findings

After gathering data from my testimonios and survey responses, I analyzed them to see what themes emerged from my participants’ experiences. Even though my participants shared experiences from different after-school programs in separate parts of California (San Francisco and Pomona, for instance), there was a lot of overlap in the types of microaggressions that were dealt with. These themes that appeared also seemed to be able to follow some sort of progression, in which a rough timeline was able to be established that outlined a generalized timeline of how microaggressions regulated the cultural norms of the space, affected the bodyminds of line-staff, and highlighted the consequences of microaggressive environments after prolonged exposure (from a couple months to 13 years). The themes that emerged from my data were: “type-casting,” “choosing your fights,” and “open door policy.”

[demographics]



[Figure 1]

Type-Casting

Type-casting is the first theme that emerged in my data, illuminated by the early interactions my participants had with their after-school system. Typically, the phrase “type-casting” is used when referring to actors being continuously casted in the same type of character roles over and over again, with little room to grow in other roles. In this same vein, type-casting as it relates to my study happens when line staff are funneled into performative and restrictive mentor roles due to stereotyping based on their identities. This stereotyping occurs at a systemic and an individual level, usually targeting their “visible” identities—most of my participants identified their race as playing the largest part in their experiences with type-casting. It is common that they are treated like the main spokesperson (by administration, typically) for the most visible part of their identity, and any nuance surrounding their experiences with the community they are being appointed to represent is not taken into consideration.

[quote: “They’ll never know who I am, because they’ll always just see my skin color.” (peaches)]

[quote: “When kids or parents were being aggressive or out of control, I’d be the one always called to handle it.” (Jhaylen)]

[theories: affect theory + intersectional microaggression]

[explanation of no likert scale questions]

Choosing Your Fights

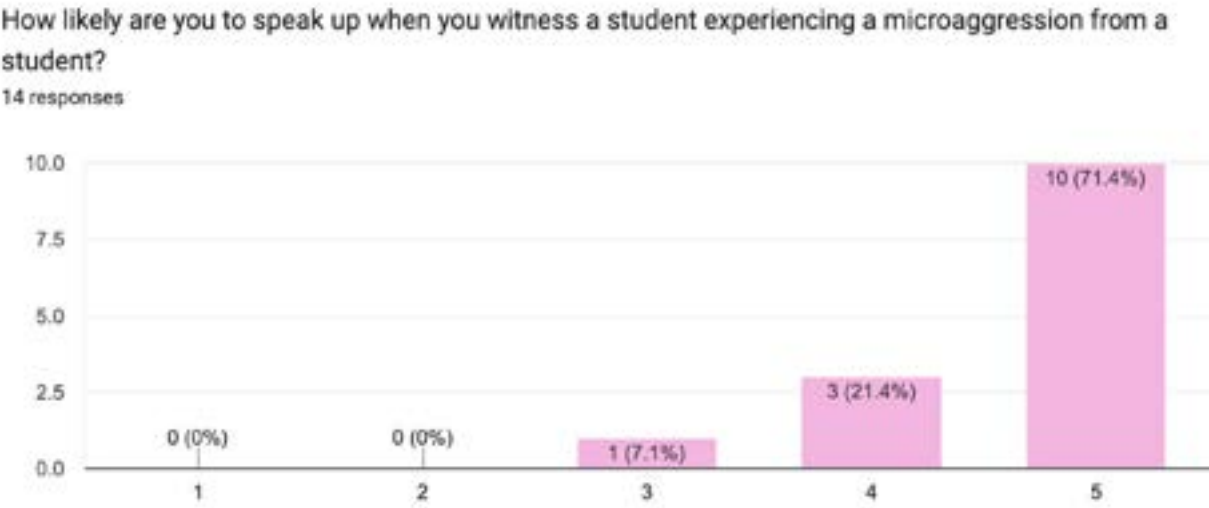
This theme centers a level of compromise my participants engaged in after being exposed to microaggressions and their work politics for a prolonged amount of time, to the point where they have an understanding of their positionality and power within the workspace. Even outside of addressing microaggressions, people tend to not instigate disagreements with superiors that have the potential to fire them from the job they are currently working. This experience of

“choosing your fights” is a constant in nearly every workplace, and the after-school system is no different. My participants felt the need to choose their fights repeatedly in microaggressive instances, often weighing the external consequences of speaking up against the internal compromise they had to make by keeping quiet. This often led to line staff allowing, or quietly tolerating, others to microaggress them for the sake of maintaining peace and keeping their job position.

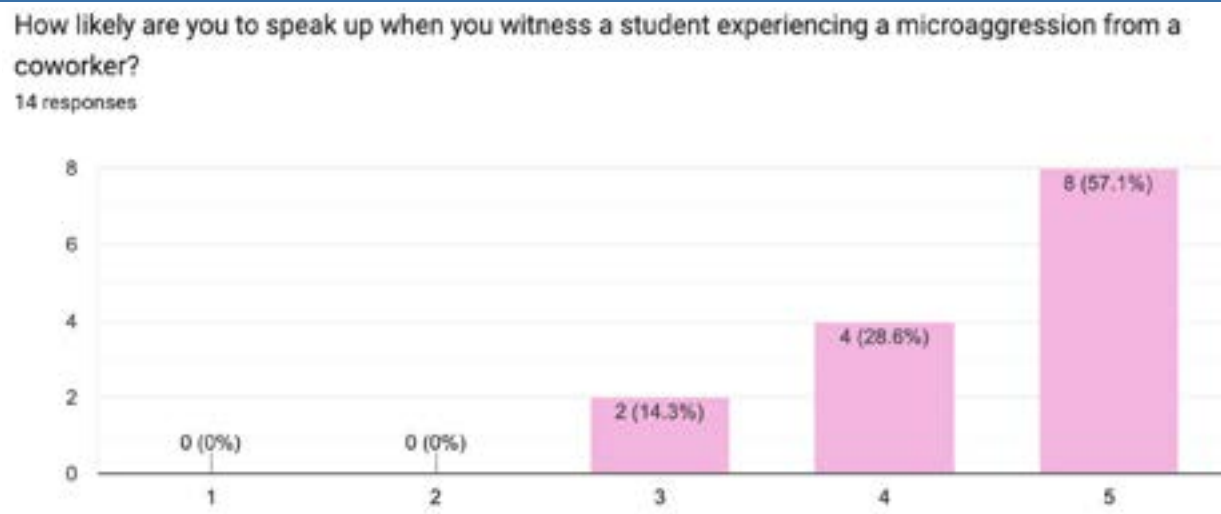
[quote: “One of my coworkers is always misgendering me, but, I don’t say anything anymore because it’s not worth the energy and I have to remind myself that it’s just work. I’m not going to see these people after my shift.” (Icarus)]

[quote: “It just makes me feel icky inside. I want to say something, but am I the only one that feels that way?” (peaches)]

[theories: femme theory + affect theory]



[Figure 2.1]



[Figure 2.2]



[Figure 2.3]

Open Door Policy

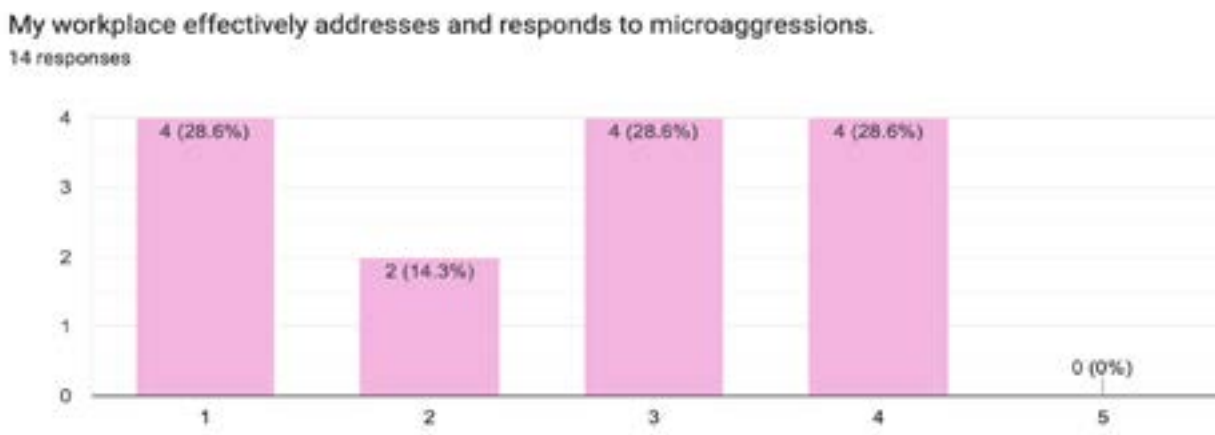
The last theme to emerge from my data is “open door policy.” While the first two themes deal with the negative lived experiences of coping with microaggressions in the workplace, this theme provides a space to validate the micro (and macro) resistance tactics my participants

employed during their time in the after-school program and outside of it. Within this theme are all the different ways my participants filled the gaps in their after-school programs to the best of their ability. Every practice of resistance against microaggressions and the structural oppression taking place within my participants’ workplaces was a learned experience of balancing care work and bodymind needs while fulfilling their passion for helping the youth.

[quote: “When I took on a supervisor role, I made sure to have an open door policy for my staff because I wanted them to feel comfortable. Past supervisors didn’t prioritize this policy.” (Bob)]

[quote: “Once I was in a leadership position, I asked to be held accountable because administration doesn’t, and isn’t.” (Jhaylen)]

[theories: abject + femme theory]



[Figure 3]

Conclusion

Microaggressions regulate after-school spaces in the form of systemic routing and individual stereotyping of line-staff. This controls the bodies of staff and molds them into a predetermined type of mentor, restricting their growth from a professional and personal standpoint. Staff are forced to undergo a constant internal compromise of identity and actions in the face of microaggressors in fear of consequences that may arise if they engaged in forms of microresistance. This takes a toll on the bodymind of the staff member, as well as external relationships they engage with, typically with people in a position of power (supervisors, for instance). Due to the necessity of care work in this space, staff were pushed to engage in microresistance tactics to preserve their well-being when they felt safe enough to do so, which seemed to occur only after working at their site for a minimum of one year.

Due to my study’s small sample size, it has a limited amount of data and analysis, but is a nice introduction to researching the after-school system. This study provided me with a foundation to build off of, leaving me with a lot of questions that I seek to answer in future research projects.

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Lee Deng, Erica McDowell, David Carranza, Axis Fleischman, Michael Martinez
SCI 1010: Freshman Experience I (Fall 2023)
California State Polytechnic University, Pomona

ADHD in Education

CalPolyPomona
College of Science

Background Information

In this study, we looked at students with ADHD and problems that they face in the classroom. Many students with ADHD struggle in the classroom due to executive dysfunction, which causes many different specific symptoms.

Introduction and Methodology

In this study, we examined how ADHD affects the education of more specifically high schoolers in America. To do this, we did a critical literature review, as well as interviews with 5 individuals who have ADHD. In the interview, we asked several questions, those regarding what it was like having ADHD in high school, accommodations they received, and methods that were helpful/not helpful with managing ADHD . Our task is to find out what techniques teachers can use to help highschoolers with ADHD have a meaningful education.

No Medication ADHD		CI	24%	2,413	2,408
Medication ADHD		CI	27%	2,428	2,413
Comparison		Mean	2,428	2,413	2,427

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3797030/>

Data from Research

Based on the research we have done we have found that:

- Students with ADHD are more likely to interrupt their education, drop courses, or fail to graduate than others
- Student use of academic support service was limited (i.e., 19.7% report receiving academic skills assistance, 34.2% report receiving tutoring services, and 58.8% report meeting with professor or academic advisor)
- Between 32% and 35% of ADHD teens will drop out of high school, compared to only 15% of teens who don't have a psychiatric disorder
- Approximately 25-40% of patients with ADHD have major reading and writing difficulties

Many of the interviewees proposed implementing:

- Making exams less timed and stressful
- More interactive methods of teaching
 - Detailed examples, visual or hands-on aspects, discussions

Many agreed with implementing:

- Small, non-repetitive assignments with short deadlines (unanimous)
- Having access to teacher's notes (4/5)
- Some guidance for studying and doing homework
 - Office hours, tutoring, study guides (3/5)
- Being able to choose the format of your final (3/5)

Discussion

From the data we collected, our proposed solutions include ones that will help with assignments, including small non-repetitive assignments with a short deadline. Assignments that are larger should be lenient and forgiving with late work. Solutions that will help with in-class work include more hands-on methods of learning, such as working with the class or encouraging discussion. Finally, solutions that will help with test taking include focusing less on timing the students when testing, and involve more difficult questions, as well as providing teacher's notes and/or a study guide for students to study.

If we were to continue this work, we would conduct a survey at a local high school. We will also try to implement this solution into classes so that students will be more successful

Conclusion

We did a literature review and interviews of students with ADHD to propose that small non-repetitive assignments, leniency on late work, hands-on teaching methods and a more relaxed test taking environment will help ADHD students due to their struggle with executive functioning and need for ample stimulation.

Acknowledgements: Professor Nina Abramzon, Olivia Walsh, and Don Dao for all supporting and assisting us during this project

Abstract

Adverse Childhood Experiences (ACEs) are stressful or adverse events occurring before the age of 18 and are linked to an increased risk of various health conditions, including depression, coronary heart disease, and stroke, potentially leading to premature mortality and diminished well-being. There are 10 types of ACEs. This study aimed to assess the prevalence of ACEs among a subpopulation of undergraduate students at Cal Poly Pomona (CPP). We distributed surveys via email, receiving responses from 1,478 students, of whom 512 qualified and completed the survey. Ten questions were included about the 10 types of childhood adversity (ACEs) and current mental health including two anxiety items ("Feeling nervous, anxious, or on edge" and "Not being able to stop or control worrying") and two depression items ("Little interest or pleasure in doing things" and "Feeling down, depressed, or hopeless"). Our data showed that 75% of CPP respondents experienced at least one ACE, with 36% reporting that they experienced three or more ACEs. The actual prevalence of ACEs may be underestimated, as individuals might be reluctant to disclose sensitive information, may have memory disruption, or might not recognize that they experienced abuse or parental mental illness. Pearson correlations were run, and almost all 10 ACEs were associated with depression and anxiety. These results underscore the need for further information about the link between childhood stress and adult mental health issues such as anxiety and depression.

Introduction

Adverse Childhood Experiences (ACEs) are potentially traumatic events that occur at a youthful age. ACEs generally refer to 10 categories of adversities experienced before age 18. These adversities include physical abuse, emotional abuse, sexual abuse, physical neglect, emotional neglect, growing up in a household with incarceration, mental illness, substance misuse and dependence, divorce and separation, and intimate partner violence, from parents. These experiences without buffering protection can become “biologically embedded,” leading to a toxic stress response (Pedrelli et al., 2015). ACEs and the associated toxic stress they create are associated with some of the most common, serious, and costly health and social challenges facing California. ACEs are linked to 9 of the 10 leading causes of death in the US and affect all communities and across racial, ethnic, socioeconomic, gender, and geographic lines (Merrick et al., 2018; Heron et al., 2019). There is an epidemic of physical and mental health decline among college students today (Merrick et al., 2019). We are also aware that although ACEs affect all populations, certain minority groups are more vulnerable (Merrick et al., 2019). Because of this, efforts that prevent adverse childhood experiences could potentially prevent adult chronic conditions, depression, health risk behaviors, and negative socioeconomic outcomes (Merrick et al., 2019). Reducing and minimizing the effects of ACEs is crucial for the improvement of overall public health and for understanding the needs of students at Cal Poly Pomona.

Data shows that early detection and intervention are associated with improved outcomes related to toxic stress (Merrick et al., 2019). Exposure to ACEs alone does not determine the

individual's future health or always result in a toxic stress response. The presence of protective factors such as supportive relationships can alter the risk of toxic stress and related health and social outcomes (Merrick et al., 2019). Therefore, ACEs screening can prevent and reduce the accumulation of exposures to adversity and the risk for negative health outcomes. Screening for ACEs to assess the risk of toxic stress and effectively responding with evidence-based care can improve the health and well-being of individuals and families for generations to come (Merrick et al., 2019).

In adolescence, ACEs and toxic stress may result in an increase in a wide range of health conditions including increased engagement of high-risk behaviors, mental health disorders, and substance use. In adults, there is an increased risk of cardiovascular disease, depression, anxiety, and chronic pain. However, there is little research on the impact of ACEs in college students specifically, even though almost 70% of all 18- to 19-year-olds in the United States enroll in college (Merrick et al., 2019). Understanding the perspective of this group of adults is critical to ensuring that services are responsive to their needs. In the current study, we determined the prevalence rate of ACES in a sample of freshman and transfer students.

Research Questions

- 1. What is the prevalence of ACEs in Cal Poly Pomona first-year student and transfer students?
- 2. Are ACEs among Cal Poly Pomona Freshman and Transfer students associated with mental health?

Method

Participants

Participants received an email that went out to all students at a four-year university, inviting incoming first-year students and transfer students to participate in the study. Of the 1,478 students who responded to the survey, 512 qualified and completed the survey. They qualified if they were at least 18 years of age and an incoming first-year student or transfer student in Fall 2023. Participants self-reported their gender (61% female and 39% male.) Ethnicity of the sample was 48% Latino or Hispanic, 34% Caucasian, 27% Asian, 3% African American, 2.5% Native American, 2.5% Native Hawaiian, 3.5% Middle Eastern, 18% other, 6% did not know their ethnic background, and 4% did not answer.

Survey

The survey was distributed by email (using a link to Qualtrics online software survey) in Fall 2023. Questions on the survey were compiled by professors at Cal Poly Pomona University and clinical mental health workers who part of the larger project were working with East Valley Health Center, Tri-City Mental Health, Clinical Translational Research Institute, and Claremont Graduate University.

ACEs

ACEs were measured with the 10 ACEs Questionnaire about childhood adversity (ACEs) commonly used in stress research. Specifically, the Adverse Childhood Experience Questionnaire for Adults (California Surgeon General's Clinical Advisory Board, 2020) was used. The measure was adapted from the work of Kaiser Permanente and the Centers for Disease Control and Prevention (Felitti et al., 1998). ACE assessments have good test–retest reliability with an adolescent sample (Oláh et al. 2023) and adult samples (Dube et al., 2004; Pinto et al., 2014).

Anxiety

Generalized Anxiety Disorder was measured using two anxiety items ("Feeling nervous, anxious, or on edge" and "Not being able to stop or control worrying"). The items are items on the GAD-2, which is a shortened version of the GAD-7, which has proven to be a reliable and valid measure of assessing symptoms of Generalized Anxiety Disorder (Spitzer et al., 2006). The 2 items are considered quite good despite being only two items. In fact, the GAD-2 had excellent overall accuracy for identifying clinically significant anxiety symptoms (AUC = 0.97, 95% CI 0.94 – 1.00). A GAD-2 cut-off score of ≥ 3 provided an optimal balance of good sensitivity (0.87) and good specificity (0.92) for detecting clinically significant anxiety symptoms (Hughes, Dunn, Chaffee, et al. 2018; Sapra, Bhandari, Sharma, et al. 2020).

Depression

Depression was measured with two depression items ("Little interest or pleasure in doing things" and "Feeling down, depressed, or hopeless."). These items are the PHQ-2 (a shortened form of the PHQ-9), which has proven to have good reliability and validity as a measure of assessing symptoms of depressive disorders (Kroenke, Spitzer, & Williams, 2003).

Before distributing the survey, the study received approval from the Cal Poly Pomona Institutional Review Board (IRB). A protocol was established to ensure that respondents who indicated significant mental health issues would be contacted for a potential mental health check.

Statistical Analyses

To determine the prevalence of ACEs, frequencies were calculated. In addition, Pearson correlations were run to examine whether ACEs are correlated with current mental health.

Results

ACEs

ACEs were experienced by many respondents, as shown in Figures 1-4 and the Appendix. 75% of respondents reported at least one ACE, with 36% reporting three or more ACEs. The most frequently experienced ACE was verbal abuse (with 49% of respondents reporting having a parent or adult in the home who swore at them, insulted them, or put them down). The next most frequently reported item was living with someone with a mental illness

(reported by 38% of respondents. In addition, 21% of respondents reported feeling no one in their family loved them or felt they were special.

T-tests were run to determine whether some respondents had more ACEs. Women reported experiencing more ACES (mean = 2.39) than men (mean = 1.84, $t = 2.99$, $p < .05$). People who reported being Latino/Hispanic (mean = 2.34) reported more ACES than non-Latinos (mean = 2.02, $t = 1.75$, $p < .04$).

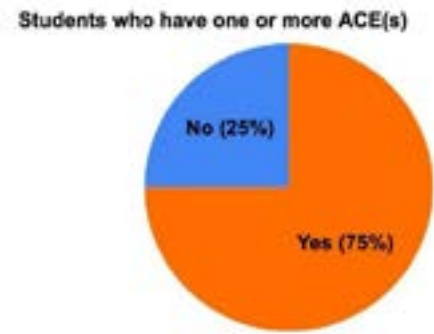


Figure 1. Percentage of respondents who responded ‘Yes’ (red) or ‘No’ (blue) to having one or more ACE(s).

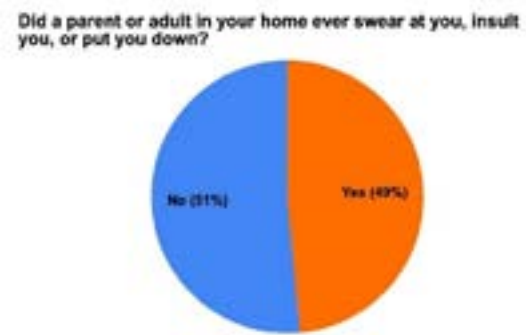


Figure 2. Percentage of students who responded 'Yes' (red) or 'No' (blue) to the question regarding verbal abuse.

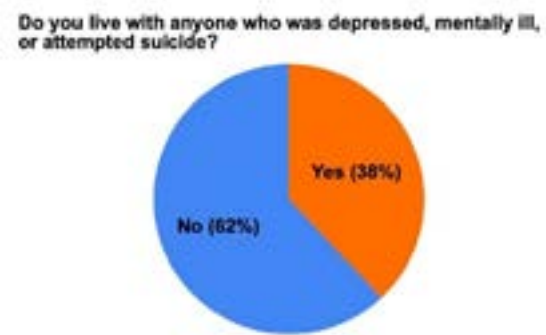


Figure 3. Percentage of students who responded 'Yes' (red) and 'No' (blue) to the question about living with someone with a mental illness

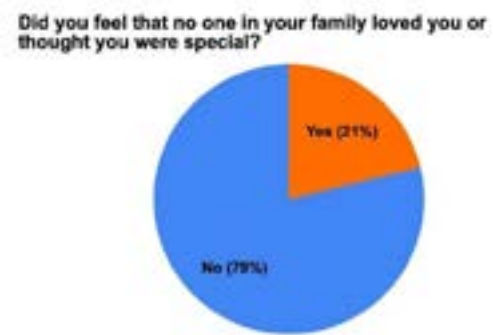


Figure 4. The percentage of students who responded 'Yes' (red) or 'No' (blue) felt a lack of love from their family.

ACEs, Depression, and Anxiety

Several Pearson correlations were run to determine whether adverse childhood experiences (ACEs) correlate with current mental health. Almost all ten ACEs were positively correlated with anxiety (“Feeling nervous, anxious, or on edge” and “Not being able to stop or control worrying”) and depression ("Little interest or pleasure in doing things" and "Feeling down, depressed, or hopeless"), with p values of .05 or less.

Discussion

Our results showed that many students in our sample have experienced one or more ACEs in their lifetime. Next, a discussion is provided of the prevalence rate, the importance of the data, limitations of self-report data, the need for more mental health for college students, and a few suggestions for mental health care (e.g., counselors and alternatives for college students).

The prevalence of ACEs found in our study tended to be higher (75%) than other studies of adults (Merrick et al, 2019). A large 2018 study in the United States (N=248,934) based on a representative US sample telephone survey found that 23% had only one ACE, 13% had two ACEs, 9% had three ACEs, and 16% experienced four or more ACEs). In other words, a total of 61% of participants had at least one ACE (Merrick et al, 2019). The reason that our rate is higher is unclear. A literature review of ACEs worldwide found that some marginalized groups had more ACEs than others (Madigan, et al, 2023). Our rate may be higher because we have more marginalized groups (e.g., more non-white Latino students in our population), compared to other populations in the U.S, given that our university is a Hispanic Serving Institution (HSI) that attracts students of diverse ethnic backgrounds. Those of different ethnic groups may experience

external forces, such as systemic racism or social determinants of health, which may be related to one or more ACEs being present (Camacho & Henderson, 2022).

Our data provides information about college students specifically. College students are in a transitional phase of life where the demands of adulthood and educational stress collide, and this can trigger the effects of adverse childhood experiences (ACEs). ACEs have physical implications, where life expectancy of individuals with many ACEs (e.g., 6 or more) have significantly shorter lives than others (Merrick et al., 2019). ACEs can affect all populations, but certain groups are more vulnerable (Merrick et al., 2019).

Efforts that prevent adverse childhood experiences could potentially prevent adult chronic conditions, depression, health risk behaviors, and negative socioeconomic outcomes (Merrick et al., 2019). Reducing and minimizing the effects of ACEs is crucial for the improvement of overall public health and for understanding the needs of students at Cal Poly Pomona.

Data shows that early detection and intervention are associated with improved outcomes related to toxic stress (Merrick et al., 2019). Exposure to ACEs alone does not determine the individual's future health or always result in a toxic stress response. The presence of protective factors such as supportive relationships can alter the risk of toxic stress and related health and social outcomes. Therefore, ACEs screening can prevent and reduce the accumulation of exposures to adversity and the risk for negative health outcomes. Screening for ACEs to assess the risk of toxic stress and effectively responding with evidence-based care can improve the health and well-being of individuals and families for generations to come (Merrick et al., 2019).

Prevalence rate underestimation

One limitation of this study is we used self-report data, and our prevalence rates might be underestimated. Depression, anxiety, and stress are often under-reported (Fekadu et al., 2022; Kasper, 2006). McKinney, Harris and Caetano (2009) found that people tended to provide inconsistent responses regarding whether they have experienced childhood abuse when asked about it on different surveys, and under-reporting of childhood abuse probably occurred.

There are a few reasons for possible underestimation of ACEs in the current study. Students may have chosen to avoid starting the survey or failed to complete the entire survey, knowing that the survey topic was stressful childhood experiences. They may have been concerned that if they answered “yes” to certain questions, that as mandatory reporters, the faculty conducting the research would have to report any disclosure of sexual abuse to the campus Title IX office. Participants were warned on the consent form that such reporting would occur.

Previous studies have suggested other reasons why adults who have been abused during childhood may not self-report their abuse and related experiences (Fergusson, Horwood, & Woodward, 2000; Hardt & Rutter, 2004; Widom & Shepard, 1996). People might not do so for a multitude of reasons, such as not wanting to divulge such personal or traumatic events to people with whom they are not comfortable (Della Femina, Yeager, & Lewis, 1990). People may choose

to not recall those experiences as they could cause them to feel pain or shame (Della Femina, Yeager, & Lewis, 1990).

Memory

Another reason for possible under-reporting is memory disruption. Human memory is imperfect and as a result people can end up with memory retrieval errors including small memory retrieval errors (Klier & Buratto, 2020), autobiographical memory disruption (or gaps in memory about an event that happened to yourself) (Edwards et al., 2001), and in many cases, the tendency to forget key memories over time due to the decline of memory traces (Baddeley et al., 2020). All of this can lead participants to under-report their ACEs due to the memories not being accessible at the time of reporting.

Overestimation of the prevalence of ACEs can also occur. False memory research has shown that people can create false memories (according to a large amount of research by Elizabeth Loftus and others). According to cognitive psychologist Dr. Kevin Autry (personal communication, May 23, 2024), the creation of a false memory is less likely to occur than forgetting. It is easy and common for people to forget events and information (e.g., like words in a list), but false memories are rare.

Cultural Responses to Survey Items

Individual differences might play a role in whether people self-report accurately. Gender differences in openness to acknowledge mental health issues have been found, with women and younger adults being more likely to report anxiety and depression (Currin, 2011). Cultural factors might play a role, also, in how people respond to the survey items. For example, some cultures are more verbally loud, and others might consider some behaviors verbal abuse while other cultures would think that the same behaviors are normal and not abuse or stressful. In addition, some cultures and subgroups might feel particularly strong shame in acknowledging abuse. It can be considered even more inappropriate to talk about or report depression and anxiety. In other words, it is OK to be sick but taboo to talk about mental health issues, due to the mental health stigma. People from some cultures might experience their disorder physically and might not define themselves as having depression and anxiety. Latinos/Hispanics may have differences in how disorders manifest themselves Attack of Nerves or “Ataque de nervios” being a culturally specific condition seen in Latin America (Keough 2009). This physical display is like a panic attack with sporadic behavior and shouting.

College Students Need More Mental Health Help

Previous studies have consistently noted that college student mental health rates are increasing (American Psychological Association, 2013, June 1). Before 2020, more than one-third of college students across the country were diagnosed by mental health professionals with having at least one mental health problem (American College Health Association, 2020). Anxiety (27.7%) and depression (22.5%) were the most frequently diagnosed disorders, and the proportion of

students with anxiety or depression has increased (Lee, Jeong, & Kim, 2021; Oswalt et al., 2020). Counseling centers have seen huge increases in demand in the past decade, with 60% of psychologists reporting no openings for new patients in 2022, according to the American Psychology Association Covid-19 Practitioner Impact Survey(2022). In one study, a large majority of students (84%) with anxiety or depression perceived the need for mental health services but only some students (37%) accessed mental health services (Auty, 2022).

Counselor to Student Ratio

The full-time counselor to student ratio should ideally be 1000 students for every individual full-time counselor and should not exceed 1500 students for each individual counselor (California Faculty Association, 2021; International Accreditation for Counseling Services, 2023). However, this ratio across the California State University system on average has reached 1900 students per counselor, with the average student per individual full-time counselor ratio of Cal Poly Pomona reaching over 2000 students (California Faculty Association, 2021) in the recent past. (See the Association for University and College Counseling Center Directors, 2013 for a full list of counselors to student ratios according to 400 center directors, including those at several California State University campuses.)

Mental Health Resources

Given the minimal access to counseling that students are currently facing, new ideas and additional resources are needed. Depending on the type and severity of the stress, universities can rethink how to provide help that does not rely solely on counselors (Abrams, 2022).

Students having mild challenges adjusting to college life and an unfamiliar environment could attend workshops (run by non-counselors) that would allow them to be more effective at managing stress and time, as well as goal setting. Those with moderately mild issues such as loneliness, mild interpersonal relationship issues, and poor self-esteem, could be provided peer counseling. At the same time, students with more severe issues, including trauma, major anxiety, and depression, can still access trained counselors for one-on-one help (Abrams, 2022).

Universities could provide spaces for peer counseling groups, group therapy sessions, telehealth services to students, and faculty training on mental health (Abrams, 2022). In addition, universities could also implement effective stress management training that provides students with the tools to combat stress, anxiety, and depression (Yazdani et al., 2010). However, more information is needed to compare the relative efficacy of mental health care (stress management training, peer counselors, counselors) to ensure college students are receiving help. Overall, whether students get help through counselors or other means, many students have experienced ACEs, which are associated with adult depression and anxiety, and resources are needed.

Appendix

ACEs were experienced by many respondents, as indicated in Table 1.

Table 1. Percentage of respondents who endorsed each ACE compared to a California sample

ACEs Category	ACEs item in our study	%
Verbal	Did a parent or adult in your home ever swear at you, insult you, or put you down?	49
Household mental illness	Have you lived with anyone who was mentally ill, depressed, or attempted suicide	38
Household substance abuse	Did you live with anyone who had a problem with drinking or using drugs, including prescription drugs?	30
Emotional (Lack of love)	Did you feel that no one in your family loved you or thought you were special?	21
Physical (Parent hurt you)	Did a parent or adult in your home ever hit, beat, kick, or physically hurt <u>you</u> in any way?	15
Witnessed intimate partner violence (Parent hit parent)	Did your parents or adults in your home ever hit, punch, beat, or threaten to harm each <u>other</u> ?	12.6
Sexual	Did you experience unwanted sexual contact...[examples]?	20
Divorce or parental separation	Did you lose a parent through divorce, abandonment, death, or other reason?	18
Needs not met	Did you feel that you did not have enough to eat, had to wear dirty clothes, or had no one to protect you or take care of you?	14
Incarcerated household member	Did you live with anyone who went to prison?	12

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Exploring Collaborative Robotic Environment: Unmanned Hybrid Vehicle, at CPP
Reconfigurable Space Computing Lab

Abstract—In the context of addressing hazardous and challenging scenarios, collaborative robotic environments play a vital role in accomplishing unsafe tasks for humans. While considerable interest exists in creating such environments for Unmanned Aerial Vehicles (UAVs), there is a notable lack of implementation for Unmanned Ground Vehicles (UGVs). This research project aims to bridge this gap by proposing a new hybrid UGV, referred to as an unmanned hybrid vehicle (UHV). The UHV is to effectively collaborate within a robotic environment, facilitating task efficiency in disaster situations, extreme climates, and extraterrestrial locations like the Moon. The study begins by modifying an existing UGV to incorporate heavy-duty propellor motors and sensors, resulting in a versatile and capable UHV. Data produced by various sensors across the system hooked up to the Raspberry Pi, which utilizes ROS (Robot Operating System), will facilitate real-time data processing, control, and communication between the UHV and other devices within the collaborative robotic environment. Subsequently, gathered comprehensive data will reveal its performance in assigned tasks, considering crucial aspects such as safety, task completion time, range of control, and overall efficiency. The envisioned outcome is a UGV that can interact seamlessly within a collaborative environment, facilitating enhanced cooperation between UGVs and UAVs when deployed in challenging conditions. Ultimately, this research seeks to contribute to advancing robotics technology, enabling the deployment of collaborative UGV and UAV systems to address critical challenges in environments where human intervention is impractical or hazardous. By combining the strengths of both ground-based and aerial platforms, this hybrid UGV promises to pave the way for safer and more efficient task execution in extreme circumstances.

Index Terms—Cyber Security, Unmanned Ground Vehicle (UGV), Unmanned Aerial Vehicle (UAV), Unmanned Hybrid Vehicle (UHV), Interface, Power Efficiency, Collaborative Robotic Environment (CRE)

I. KEYWORDS

- 1) **Cyber Security** - Security from attacks that originate from the internet.
- 2) **Unmanned Ground Vehicle (UGV)** - A vehicle that can be controlled remotely and can navigate on the ground.
- 3) **Unmanned Aerial Vehicle (UAV)** - A vehicle that can be controlled remotely and can navigate in the air.

- 4) **Unmanned Hybrid Vehicle (UHV)** - A vehicle that can be controlled remotely and can navigate on the ground or in the air.
- 5) **Interface** - The ability of a system to communicate with devices physically or wirelessly.
- 6) **Power Efficiency** - The attribute of something to not expend much energy.
- 7) **Collaborative Robotic Environment (CRE)** - An environment where robots or devices can collaborate to accomplish a task or goal.

II. INTRODUCTION

IN today’s world, wildfire disasters endanger citizens and first responders. Does this have to be the case for both sides? The hard truth is that minimizing the spread and containment of wildfires is the leading way of combating wildfires. As of recently, robotics have helped aid in the safe containment of fires to protect the first responders and, ultimately, the citizens. In” Climate Change is Increasing the Likelihood of Extreme Autumn Wildfire Conditions Across California,” in 2020, note the following in their climate study in which they take into account various data points—spanning from 1979-2018—of the Fire Weather Index (FWI):

Second, although the high-resolution climate datasets enable analysis of historical and projected changes in extreme fire weather potential, gridded datasets are imperfect approximations of real-world weather conditions, climate trends, and the response of local climate to changes in forcing (including the mesoscale atmospheric dynamics that generate strong wind events) [1].

Due to the challenges in obtaining accurate wildfire data, it is essential to improve the clarity of the recorded data approximations safely and accurately by collecting data in real-time. Not only can robotics help in this area, but they can also help contain the fire itself by rigging proper equipment. Thus, a robot that can gain data and combat wildfires is needed.

Unlike wildfires, earthquake aftermaths may cause a very extreme atmosphere, making it hard for first responders to help victims. Earthquakes are the central issue in states and areas such as California, especially as the” Big One” is said to inevitably rear its ugly head, changing many lives when they occur. Only a little can be done during earthquakes to minimize them, but evacuations and solutions to deal with the aftermath are critical. Robotics has also happened to show up in this type of disaster. Take what is proposed in ”Complete Coverage Path Planning for a Multi-UAV Response System in Post-Earthquake Assessment,” which mentions an ”unmanned aerial vehicle” that can take images and make a ”response map” [2]. Such an unmanned aerial vehicle (UAV) is a highly effective implementation for earthquakes as it can help aid first responders. However, it is crucial to remember that different vehicle types may also be needed to grasp a more specific situation to assess and set on route to do another essential task, which may lead to more resources for first responders.

Robotics need not be applied only where disasters lay but where no one person can go. Whether on the Moon or Mars, there is a definite need to produce technology that eases the crew’s lives once they head to accomplish their mission, as the many unimaginable hardships of the universe hinder them. Different celestial bodies in our galaxies happen to have extreme atmospheres. Where there is the extreme, robotics have already found applications there. Take, for example, the rovers that traverse Mars and collect samples of the environments they explore. With the National Aeronautics and Space Administration (NASA) planning its Artemis mission, more vehicles must interface with other robots or mechanisms. According to NASA, in their work NASA’s Lunar Exploration Program Overview, they lay out a meticulous plan where the Artemis mission is split up between Artemis 1, Artemis 2, and Artemis 3 so that the completed Artemis mission will have them move on to reaching Mars and more [3].

As can be seen, it is critical for no failure to occur at any stage in the mission, and accomplishing such a mission has already been thought out as NASA, in the same work, details that they plan to develop ”mobility systems,” ”human exploration systems,” ”component/sensor/technology,” and much more regarding building housing and infrastructure on the moon—all of which they will manage via stakeholders [3]. In all, the moon is the ”Next Frontier” regarding achievements in science, research, and initiative.

Moving on, there is the topic of security and cyber security protocols, which are all critical to the above situations where different vehicles or robots interface. If a device malfunctions, jeopardizes security, or someone near such technology figures out how to hack or manipulate it, that situation is terrible. In the article,” Hackers Remotely Kill a Jeep on the Highway—With Me in It,” by Andy Greenberg, hosted on the webpage Wired, they mention that, concerning the hacking of a Jeep, the hackers” Miller and Valasek’s full arsenal [included] functions that at lower speeds entirely kill the engine, abruptly engage the brakes, or disable them altogether.” [4]. Safety and cybersecurity are the same in the end, as accidents could occur concerning newer technology vulnerable to interference, interception, and bugs. It is up to the developer of a technology

to have due diligence and implement a way to stop such risks in safety and cybersecurity to maintain the integrity and competence of their product.

Lastly, there is the concept of using a hybrid approach when making a device work for two purposes. Take into account the Panther Drone that the Company Advanced Tactics introduced in ”Advanced Tactics Panther Drone Has Completed First Aerial Package Delivery Test with a Safe Drive-up-to-your-doorstep Capability,” where the drone happens to be able to drive and fly to deliver packages to people’s mailboxes in figures 1-5 [5]. The Panther Drone can hybridize and fly when needed to deliver mail, making it a one-of-a-kind device. Unfortunately, devices like it can get complicated (hardware-wise, software-wise, and legally), so there are few drone types in circulation, if at all. However, it is critical to remember such a device as an essential concept because it can have beneficial applications elsewhere!

III. RESEARCH PROBLEM

The issue is that there is no collaborative robotic environment in place that can help to quicken the pace of tasks in different circumstances. In many complex situations involving wildfires, earthquakes, or space missions, initially, there is a limited number of people, which leads to a limited amount of labor. Thus, what can be deployed in scenarios involving wildfires, earthquake aftermaths, or space missions on other celestial bodies to keep corresponding people and information safe and able to contribute in the designated scenarios? Knowing the context, how can introducing an unmanned hybrid system, built out of a previously made unmanned ground vehicle, help tackle various issues and create a robotic collaborative environment?

IV. PURPOSE STATEMENT

The research aims to introduce an unmanned hybrid vehicle to accomplish tasks during disasters or situations that may put people at risk.

V. RESEARCH QUESTIONS

- 1) What contributions could an unmanned hybrid vehicle make?
- 2) How is a versatile system not riddled with compromises, and what do these compromises mean?
- 3) What methods would give the system optimal security?

VI. METHODS

Security and cyber security are vital, and legal troubles arise where wrongs exist and put people at risk. Specific parameters must be set physically or digitally for security to keep technologies in check and people safe. Likewise, cyber security needs to be present to protect from cyber-attacks. Take the case in” Methodology of Using Terrain Passability Maps for Planning the Movement of Troops and Navigation of Unmanned Ground Vehicles,” where Dawid and Pokonieczny analyze which algorithm is safer to use when it comes to mapping a route for their UGV:

This makes the Dijkstra’s algorithm more secure because it always avoids areas that are harder to overcome. For greater beta values in function (1), it never generates a route that crosses terrain of an actually worse passability. On the other hand, in very detailed passability maps (2 m and 3 m) in greater beta values in function (1) the A-star algorithm generated routes that led through less passable areas. In this algorithm it is sufficient to set a small beta value (not exceeding 8) in function (1) to obtain a route that meets the assumptions of this variant—longer but easier to overcome. Due to the fact that we do not know the exact value of beta, which will cause the shortening of a route and lead it through areas that are harder to overcome, it is more secure to use Dijkstra’s algorithm [6].

In their work, Dawid and Pokonieczny explain which algorithm is safer, which is commendable as using the worst algorithm could lead to many issues arising when implementing it in tandem with technology. Thus, because of security, it is no wonder companies and researchers look into producing specific solutions to their problems, as specific variables that go wrong can easily be accounted for and corrected.

Next, a reason to discuss an unmanned hybrid vehicle is that it can help aid in a robotic collaborative environment specifically for solving smaller-scale problems. For example, the work titled “Development of a Robotic Vehicle Complex for Wildfire-Fighting by Means of Fire-Protection Roll Screens” mentions that the UGV they plan will have the following features:

The scientific missions of the paper are: substantiation of the fleet of the multi-agent robotic complex for wildfire-fighting by means of fire-protection roll screens; substantiation of the structure of the multi-agent remote control system; substantiation of the structure of the poly-joystick based remote control interface [7].

In the same article in figures 1-3, Nikitin et al. seem to propose a “fire-fighting robot,” “tree-harvesting machine,” and “robotic trench cutting machine” [7]. Nikitin et al. propose a lot; however, there is room for condensing three robots to one by adding modularity. The feature can come in the form of having attachable and detachable pieces or simply by having features turn on and off when needed. Overall, the conjunction of small-scale UGVs has room to exist as these UGVs excel through working in groups.

Going off the idea of condensing robots, what if a small UGV and UAV merge into one system? Unmanned Hybrid Vehicles (UHV) will handle the harsh circumstances/environments produced in scenarios such as a wildfire or earthquake aftermath and for utilization at another celestial body. This vehicle would then be able to provide applications that will protect space crews by having the UHV take over exploration of the lunar surface, for example. The vehicle shall use up as little energy as possible, be fire resistant, be able to resist winds and travel quickly. The data collected in the research project shall be energy utilization, energy wasted, and

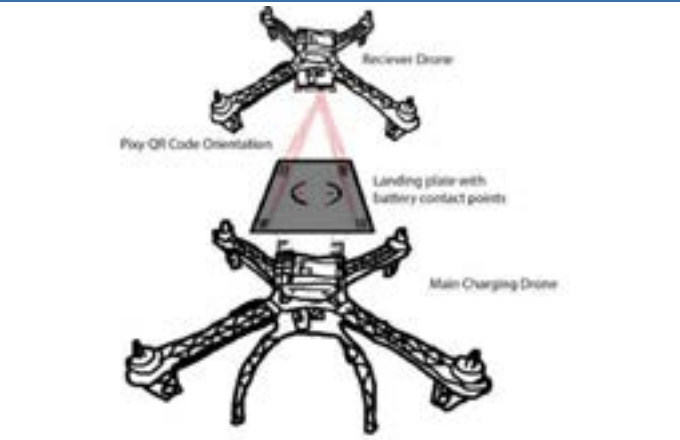


Fig. 1: Drone Docking Mechanism

the speed at which it can do a task. The tools utilized are the multimeter, oscilloscope, and speed sensor (or tachometer if unable to implement it). Various systems, sensors, and designs will be utilized in the lab to make an efficient vehicle. As the approach to what can be deemed the “final product” occurs, prototypes will undergo production and testing. Features may change depending on what occurs during the iterations of the prototypes, but the same goal will apply. If possible, the UHV will be tested in a simulated environment, as close as possible to either of the following domains: a wildfire, earthquake aftermath, or moon-like territory.

Lastly, one aspect that is very important to add to the proposed UHV is the ability to interface with other vehicles of its type and UGVs and potentially other UAVs. The way a UHV will interface with other devices will be through utilizing the internet. The communication between a UHV and UGV or a UAV should occur through the same method to avoid causing complexity. The integrated networking will allow communication and data exchange between vehicles through some encryption needed to prevent signal hijacking.

VII. MOTIVATIONS AND ETHICAL CONSIDERATIONS

There needs to be a robotic vehicle system, similar to an unmanned ground vehicle (UGV) and unmanned aerial vehicle (UAV), that can be as versatile as possible, thus the proposal of the unmanned hybrid vehicle. Complex events such as wildfires, earthquake aftermaths, and space missions may require technology that specializes on a broad scale. Ethically, some aspects, such as the ability to help during a wildfire or earthquake aftermath, cannot be tested. The hope in this case is that if the UHV inhabits the harsh environments of the moon, it can also be adapted to aid in disaster situations. Though outer space and wildfires differ, the plan is to have a reconfigurable UHV. For all intents and purposes, simulations of wildfires, earthquake aftermaths, and moon missions can occur. Such simulations lead to potential pitfalls that will undergo discussion. Safety precautions with the equipment will be used at all times to ensure no accidents occur that could jeopardize anyone.



Fig. 2: CPP Collaborative Robotic Environment

The final goal is to build a swarm of drones and UHVs that will collaboratively identify a set of rules to allow them to dock in mid-air to exchange data and energy. As shown in Figure 1, there will be a mechanism for these drones to identify specific spots to land on each other while operating in the air. Moreover, as shown in Figures 1 and 2, we can add UAVs as drone carriers based on the Traxxas RC car we received from our JPL/NASA collaborator for such work. The plan is to have the UHV be able to charge via such a vehicle or, at the very least, transmit data to the bigger Traxxas RC car. The UHV will use big motors and propellers to accomplish driving on the ground and flight in the air.

VIII. PROGRESS REPORT

A. August

In August, the UHV began to be envisioned. Initially, the previous year’s project, the UGV used for the Collaborative Robotic Environment, was to be repurposed to fly. However, it was incredibly unfeasible for it to fly. The reason was that it was simply too heavy. To have propellers or engines create lift and have the system fly would consume much power and cost a lot from a financial point of view. Luckily, the Jetson Nano could transfer camera systems and the Internet of Things from the previously presented UGV. A decision to use a small design occurred when it came to defining the flying capabilities of the project. Above this, the envisioning of a design prototype from a project that did not work at all occurred to repurpose it. The current model appears in Figures 2 and 3.

B. September

In September, the plan shifted from using the Jetson Nano since it was limited in terms of what libraries it could support. Above this, one of the loaned equipment available for the project was a Navio 2 hat compatible with a small computer known as the Raspberry Pi 3 and future renditions of the device. Therefore, one cannot exactly port the code for the Jetson Nano over to the Raspberry Pi. However, it can be updated to use the RPI.GPIO, which is similar to the JETSON.GPIO library (the previous UGV project’s GPIO Library).



Fig. 3: Inherited Prototype

The decision to use the Navio Operating System (OS) was made. This OS differs from the Raspbian OS because it does not carry any GUI and acts as a shell where the commands and basic outputs occur. The prototype driver code’s writing happened near the month’s end. However, the hat produced no proper signal; the next steps were to work on the computer vision aspect, as there was hope that the hat would be fixable.

C. October

Moving on to October, the continuation of work on the computer vision portion of the project and successfully downloaded Mediapipe onto the Raspberry Pi. However, more is needed because it allows teleoperation through a camera feed, but it might come into play later. Various tests conducted on the built system, as shown in Figure 3, determined the problem. The Navio hat works; however, the electronic speed controller (ESC) does not. The issue with the ESC is that one of the motors does not work because signal production has not begun. The issue persists with the ESC even after resoldering that portion correctly. The solution is expensive and involves replacing the ESC for the same or similarly priced ESC for around \$200. Luckily, the creation and further testing of some driver code can continue to get the other portions of the UHV running for a while.

D. November & December

Unfortunately, after running some tests in November, the system’s stability is short because the Navio2 cannot retain its proper powering and shuts itself off when it tries to power the side of the ESC that does not work. Besides this, the project entered the NASA Minds competition, resulting in the compilation of a preliminary design report. That report outlines soon-to-come features and also when accepted, the preliminary design report will get the UHV funding for the following: Acrylic sheets, a new Navio2 Flight Controller, Propeller Motors, Wheel Motors, ESC, 4s Battery, Telemetry Radio, Camera, PLA Filament, LiDAR Sensor, Wheels, Propellers, Multicamera adapter, Jumper wires, Infrared LEDs, 2TB SSD. Acrylic sheets, PLA Filament, and jumper wires were outlined in that report to allow for wiring, printing of

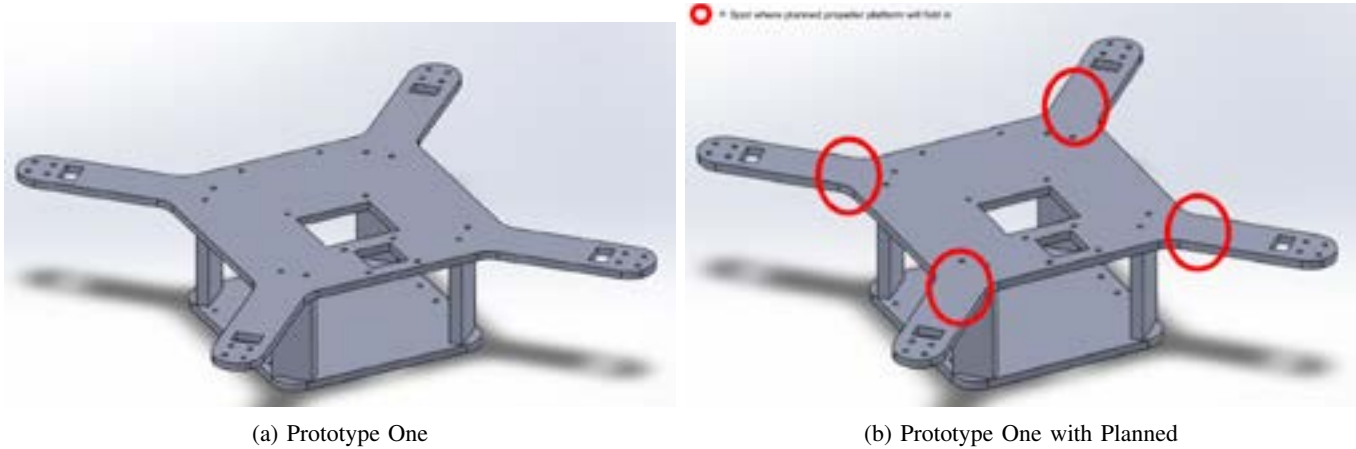


Fig. 4: Prototype Chasis

parts, and assemblage of a prototype. Better propeller motors and wheel motors were outlined in the report to allow for better load carrying when traveling on the ground and flying. The mentioning of a new Navio2 Flight Controller came about to have a spare for a second equivalent system, and the same goes for the extra battery. The idea of incorporating a LiDAR, a camera, and a multicamera adapter came about in the report to allow for the ability to have many cameras at different angles to aid in simultaneous localization and mapping (SLAM). The plan is to have different camera filters to detect light emitted from infrared LEDs, allowing for dark area exploration. The proposal mentions the 2 TB SSD because YOLO V8 or similar computer vision software shall utilize them, leading to autonomous driving. Lastly, the telemetry radio will be used for communication alongside the internet for IoT applications.

In December, the acceptance and funding from NASA Minds led to the preparation for incorporating the components and materials discussed moments ago. An early revision of the UHV is presented in Figure 4a. The plan is to add modularity to the propellers so that their platform folds in when the UHV is on the ground, as seen in Figure 4b. When attempting to fly, the car's wheel motors will be off, and the platform will fold outward to allow the UHV to fly. More is to come in the future, but much discussion and investigation is still needed.

E. January

In January, the tough decision was made to ditch the Navio2 hat and reassess much of the condition of the project. The hat was found to be unreliable and hard to script. As such, a move was made to utilize Raspbian OS, which comes with a GUI and is still within the Linux ecosystem. This enabled the use of a meta OS, alongside the Raspbian OS, known as ROS (Robotic Operating System). ROS operates on a publish-subscribe and service-client model where nodes (independent processes) communicate with each other by publishing messages to topics (for asynchronous communication) and by making service requests or responses (for synchronous, request-reply communication) through servers and clients. Depending on the Debian version, the desired ROS functionality becomes more accessible or limited. The

Debian version "Buster" was used for the Raspbian OS. The downloaded version of ROS was called ROS Noetic for ROS 1. Though not the most up-to-date, it provides simple functionality and access to many useful packages. Such packages include rplidar, hector-slam, and mavros. Though theoretically, this would be all needed to run the UHV, the aid provided by the Pixhawk 4 microcontroller uses specific sensors and devices, like the GPS, radio transmitting controller, and radio receiver for radio communication and control.

The use of the packages for rplidar and hector-slam came into motion. The rplidar package would allow our specific Lidar to communicate via a USB port with the Raspberry Pi 4 to get powered on and generate data. At the end of January, this package and the scripts that came with it allowed the Lidar to work correctly. As for hector-slam this package took in data from the sensor the Lidar was hooked up to, which generated a point of origin that was mapped onto a program called RViz. RViz displays map data and sensors' positions and orientations. So, as seen in Figure 5a and 5b, the Lidar first generates data, which is then passed to process on the Raspberry Pi 4, which then gets mapped onto the RViz program, which displays current map data and position plus orientation of the device via a sensor, and then produces more map data as the sensor moves around the room. A thing of note is that the green line represents the path the sensor has taken/traveled and is valuable since it can trace us back to the origin. The data produced can be retrieved via rostopic echo command or accessed directly from a script to be further parsed.

F. February

The mavros package began to be explored in February. This package allows us to communicate with the Pixhawk 4 microcontroller and, basically, also leads to easy control, easy access to data from the sensors, and communication between the Pixhawk and Raspberry Pi 4. Unfortunately, issues arose in getting the Pixhawk and the mavros to interface, but this was solved via the download of the mission planner software by ardupilot. This software connects a computer (the Raspberry Pi 4) and the Pixhawk. Once the software connected both,

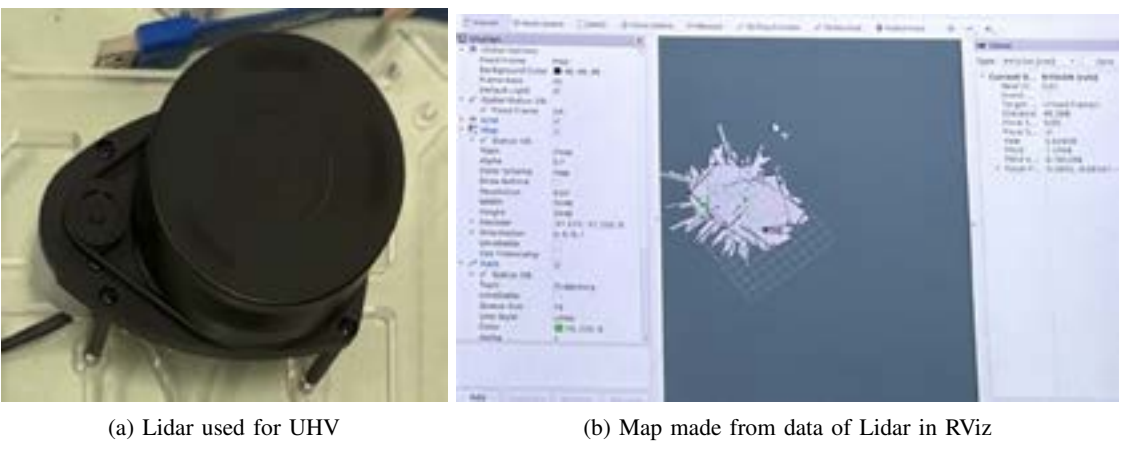


Fig. 5: Lidar, Lidar Data, and Map in RViz

mavros ran as expected on the Raspberry Pi 4 via ROS. A snippet of the data obtained can be seen in Figure 6b. The data comes from the Pixhawk microcontroller and details up the system's orientation, angular velocity, and linear acceleration. Gathering this data is important for keeping the system at level when flying.

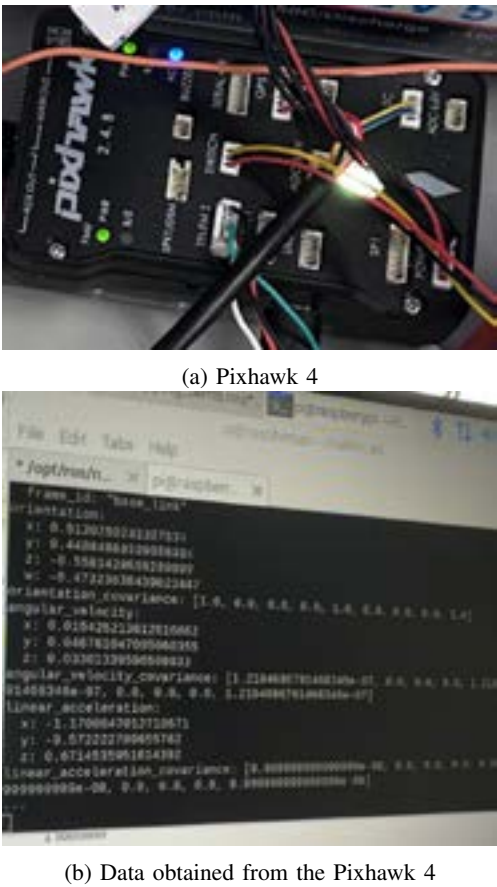


Fig. 6: Pixhawk 4 and Data Obtained

Preliminary flight tests occurred via the mission planner software on a different computer. This was done to tune the speed and device overall. At first, there were issues pairing

the Pixhawk and the controller. These were mainly due to the battery and sensors that the software saw as important and prerequisites to mission planning and controlling. Once the controller communicated with the Pixhawk via the software, one of the motors did not work. This was because of a faulty electronic speed controller (ESC). After finding that the ESC was faulty, it was replaced with a working one, and all the motors passed that test. Then came the various flight tests where the upper half of the UHV did not fly at all. So, the task of tuning and testing the speed and PID of the motors began in late February.

G. March

The beginning of March came with lots of success. The project flew due to proper tuning and changing the top half, as seen in Figures 7a and 7b. The main changes were having the speed at max and the propellers facing up to the sky rather than the ground. Alongside this, the bottom half portion of the project was assembled and resembles that of a tank. Since lots of dust covered the moon, the mecanum wheels were no longer seen as ideal since the dust would restrict their motion compared to treads (which are designed for rugged terrain). Currently, the bottom half is not functional but is in the works. The new look of the current top half of the UGV can be seen in Figure 8; note that the change proposed in Figure 4b is still in the works, too. By the end of March, many changes had occurred to the actual physical project. The same Raspberry Pi 4, Pixhawk, sensors, battery, treads, and basic wiring were used in this updated model, except that movement to a new frame occurred at this time. The only changes were moving from four ground motors to two, using carbon nanofiber, and changing the propeller motors with new propellers. The benefits of the change were that two ground motors would save on battery life and were all needed for movement and steering. As for the move from an acrylic base and PLA filament for the body to carbon nanofiber, this would reduce the UHV's weight. As for the change of propeller motors and propellers, it would allow for more lift. In the end, the introduced changes were made to conserve power and make the UHV lift as much as possible. The changes can be seen in Figure 9.



(a) Unmanned Hybrid Vehicle Flying in Flight Test (b) Older Version of Current UHV Prototype

Fig. 7: Unmanned Hybrid Vehicle



Fig. 8: Updated Top-Half of UHV Linked to Raspberry Pi 4



Fig. 9: Current UHV

H. April, May, & Future



(a) PWM Wave at 0% Duty Cycle (b) PWM Wave at 50% Duty Cycle



(c) PWM Wave at 100% Duty Cycle

Fig. 10: PWM Waves at Various Duty Cycles

When April began, a control scheme was made that uses the WASD keys on a keyboard to control the vehicle’s ground motors. This was accomplished by using the GPIO pins of the Raspberry Pi 4. Pins 18, 17, and 22 controlled motor A; meanwhile, pins 13, 23, and 24 were used to control motor B. Pins 18 and 13 controlled the respective speeds of each motor using a PWM wave, as seen in Figure 10a-10c. Depending on the waveform’s duty cycle, the motors would not move, as produced by the waveform seen in Figure 10a, have moved at a slow or normal pace in increments of 10, as seen in Figure 10b, and move at their fastest speed through the signal in figure 10c. As for motor A pins 17 and 22, depending on whether 17 was on and 22 was off or vice versa, this controlled whether that motor would move counterclockwise or clockwise. For motor B, pins 23 and 24 accomplish the same function. Using the WASD keys, the W and S keys allow the UHV to move forward and backward, and the A and D keys allow the device to steer left or right using the treads. To speed up the device, the J key was used to slow the UHV’s ground controls, and the K key was used to speed up the system’s ground controls.

In about mid-April, planning on how to merge the RViz map, motion controls, and a camera feed underwent operation. The latter was easy to implement. The implementation of the camera controls using a PiCam for prototyping was successful. The camera worked as intended; however, orientations have to be tested. However, the project seems to have slowed down due to complex direction and limited time. This mid-April point was challenging since there was no real way to implement the amp into the camera feed without an open-source library’s help or by making software from scratch. The latter option is not much of an option since this would end up being its project in developing software that merges the map and camera vision. Naturally, going with libraries is easier since it is not as complicated and time-constrained. The open-source libraries that could be used are YOLO, OpenCV, or both. However, one issue that came up was that it was not straightforward and required lots of time for training. Also, both libraries would

not merge the map and camera as much as they would enhance either.

As such, training using YOLO or OpenCV will soon occur. This has not yet been accomplished fully because they take a long while to train and set up for the detection. The only concern with this approach is that it takes up too many resources like the CPU, RAM, and battery life. As such, using the libraries in programs would then lead to competing with what can run at a single given time. The hope is also to make a control scheme and merge the ground and air controls to make a cohesive script that allows for safe control of the UHV. In the future, what is to come is also the training of the vehicle to accomplish missions autonomously, communicate with other devices or vehicle types, and make a big map out of the maps produced by the data to train the UHV to navigate and explore. The future looks bright!

APPENDIX A
CURRENT TIMELINE



Fig. 11: CPP Collaborative Robotic Environment Gantt Chart

ACKNOWLEDGEMENTS

We would like to acknowledge the Reconfigurable Space Computing Laboratory (RSCL), the teams of NASA MINDS 2021, NASA MINDS 2022, and NASA MINDS 2023 (of which they all were part of RSCL). Their instrumental work would not have led to the current project! Above all, we would like to personally thank Christopher Rosas, who has built a lot of pieces for this vision, Manuel Tarula-Villareal, Dennis Lee, Javier Eguia Chaire, and Justin Villamil for helping test the systems to see what works and what does not.

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Tercero Ana* Exploring the Influence of the Mental Timeline on Recognition Memory through the Use of Electroencephalography

Time is a unique concept given that it cannot be physically experienced through our senses. Research has suggested that it cannot be physically experienced through our senses. So instead, we utilize metaphorical representations (Lakoff & Johnson, 1980) with time being represented as space. This is known as the mental timeline, and the present study focuses on exploring whether the mental timeline influences individuals’ recognition memory.

Evidence for the existence of the mental timeline is derived from a study conducted by Lakoff and Johnson (1980). They determined that our conceptual system consists of our experiences which we independently define. They go on to state that these concepts are made up of spatial relations, physical ontological concepts, and set of basic experiences or actions. The conclusion they reached reflects that our way of structuring and understanding the concepts we gathered from our experiences is done through metaphorical mappings. These findings are significant to the existence of the mental time due to the support it establishes. They showed that all concepts we gather are dependent on components which are derived from the way we establish concepts through space, which is the mental timeline.

Borodinsky supports the existence of the mental time through experiments she conducted which suggested that space and time have conceptual similarities beyond language. She established that “people can use spatial information when thinking about time, but not temporal information when thinking about space” (Borodinsky, 2000, pg. 16).

Likewise, Furhrman & Borodistky (2010) tasked the participants to make temporal judgements. They assumed that English speakers would automatically map events that occurred earlier onto the left side of space, and vice versa with events which occurred later on the right

side of space. But more importantly, they established the idea that if there was a disruption while they were performing the temporal judgment task, and they are asked to map earlier events on the right, rather than the left, their response time would be expected to have a delay. These findings play an important role in our own study because it establishes how non-congruence has a measurable effect which is essential to our developing understanding on the mechanics of the mental timeline and how it influences recognition memory.

The establishment of the existence of the mental timeline has helped establish many fascinating concepts, like how an individual's mental time can be influenced by reading direction, but specifically, it has also aided in developing how recognition memory is also influenced by the mental timeline. In Saj, te al., they determined our ability to represent time through space, it is necessary that we have accurate temporal representations.

Previous studies have established the existence of the mental timeline, the congruence of our memory with our reading directions and how we represent time spatially, but there still remains a lot that is unknown to us about the mental timeline, such as to what extent it influences memory for temporal information. Which is why our study focused on manipulating spatial location to activate the mental timeline. We were specifically testing whether the location of the information presented to participants influences their recognition memory for the items and their temporal associations.

Our intended way of measuring the extent the mental timeline has on recognition memory, was through the use of EEG or electroencephalogram. This method allows for researchers to record the electrical activity in the brain. The way this method works is through the use of electrodes, which are small discs with a circular metallic plaque and gel, which works as the bridge between the electrodes and your scalp. The job of the electrodes is to pick up the

electrical charges your brain is emitting, so that the charges can be amplified and read/interpreted.

In testing whether location influences participants’ recognition memory for the items and their temporal associations, we are focusing on a specific ERP from the EEG data we are collecting. Event related potential (or ERPs), are specific neural responses which are reflected through a spike in activity which are by measuring voltage changes in the brain that follow (or precede) specific sensory stimuli (Bradley and Keli, 2012). Different ERPs reflect different different cognitive processes. We are specifically focusing on N400, which previous studies have established is sensitive to memory processes and is directly sensitive to memory trace strength, which means that N400 is directly sensitive to the memory of that event/stimuli. With N400, we are specifically measuring its mean amplitude across all the data we collect, because it is able to measure memory due to it being influenced by memory strength. In our study specifically, we expect to see higher N400 spikes in incongruent trials due to our understanding of how memory recognition is slower/delayed when the information presented is incongruent to your mental timeline.

Subjects were studying past and future items on the left and right side of the screen. Their recognition memory was then tested along with measurements of event-related potentials with EEG recording. We expected subjects will have greater recognition memory with information presented to them in congruent trials (e.g, past items presented on the left) compared to incongruent trials (e.g, past items presented on the right). We hypothesized to see the N400 amplitude be greater in recognition memory. We expected larger N400 amplitudes in the incongruent conditions compared to the congruent conditions. For this ERP, we typically see bigger amplitudes when there are violations of expectations.

Method:

Participants

In our current study, we aimed to have a sample size of 45 participants. We recruited students through the Sona system where they could see a description of the study, available time slots, and how many credits they would earn for their participation. Upon the arrival of the participant, the RAs ensured that the participant were the one which signed up through Sona, and had them read and sign the consent form, where the RA then recorded demographic information about the participants such as age, gender, and handedness.

Materials

Our study utilized a BrainVision 32-electrode actiCHamp EEG system. The usage of EEG aids in measuring electrical signaling in the brain through the use of electrical currents. It is primarily used because of its ability to detect and record our brain’s electrical current. In order to get an ideal read on our brain’s electrical current, we used electrodes, which measure the current, and salt water gel, which is what worked as the bridge connecting the gap between our scalp and the electrodes.

There were forty line drawings used as experimental items, and another 16 fillers for the recognition task. These were borrowed from Saj et al.(2013). These images that appear to the participants show a young boy/older man which appear alongside the items. The images of the young boy/older man were introduced to the participants as David. These images of David included his preferences which belonged to the future and were represented using an image of a man with glasses, and David’s preferences which belonged to the past were represented with an image of a little boy in a blue shirt. The study distinguished which icon belongs to David’s past or future self. The images represented things David liked to eat (e.g., apple), things he liked to

wear (e.g., sweater), things he liked to do (e.g., skiing), and things in his home (e.g., refrigerator).

Procedure

Participants signed up through the Sona system, then came to the lab at their designated time. Upon their arrival the present RAs will verify that the participant is in fact the individual who signed up for the study. Once that confirmation was received, RAs provided the participants with the consent form, where they were notified that in order for the study to continue, the consent form must be signed by both the participant and RA. Participants are also notified that one copy of the consent form will remain within the Lab, and one if for their own records. Once the consent form is signed, the participant will be asked to provide demographics (e.g., age, dominant hand, and gender). Before the capping procedure begins, RAs verified that the participants were not allergic to salt water or alcohol, due to salt water being what the electrode gel is made up of, and alcohol wipes are used to sanitize the places where the face electrodes go. Finally, they begin the memory procedure. They were introduced to a character named David. They were studying the items presented to them regarding David’s preferences from the past and future. The item presented to them were either in congruence with their mental timeline (e.g., past items on the left) or incongruent (e.g., past items on the right).

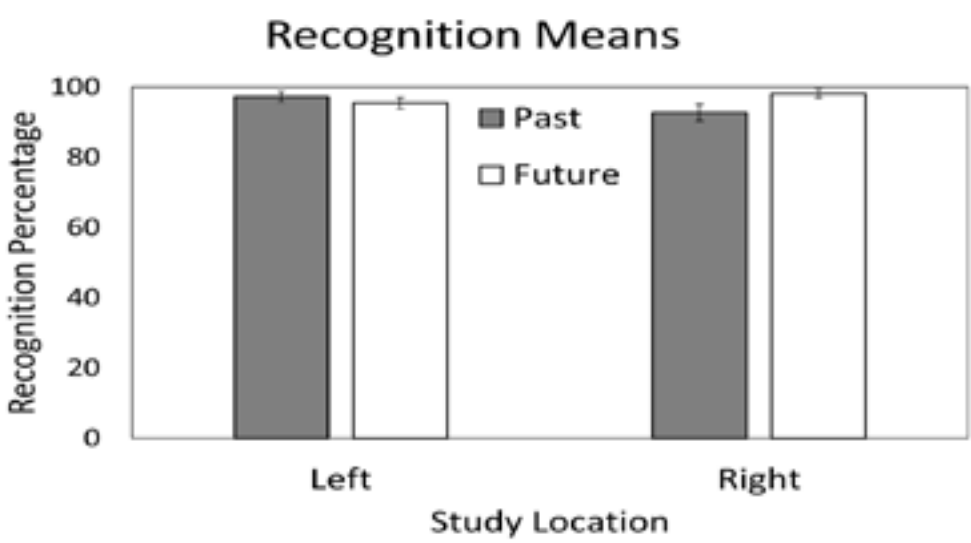
The study consisted of four blocks, each one will contain 10 study trials and 14 recognition trials. The images shown to participants consisted of a picture of young or old David along with the preferences he had during that age. The images were presented to them one at a time on either the left or right side of the screen to activate the mental timeline and how we associate the left with the past and the right with the future. The participants were then asked to recognize as many images and temporal associations as possible. They were given 3 seconds

before they were asked to verbally say what they were seeing on the screen, i.e., “Apple, ten years in the future” or “Skating, ten years ago”. The recognition phase consisted of the subjects being shown images which were either previously presented or newly shown to them. They were asked to identify whether they have seen the images before, and if they have, to also state the temporal association of the image.

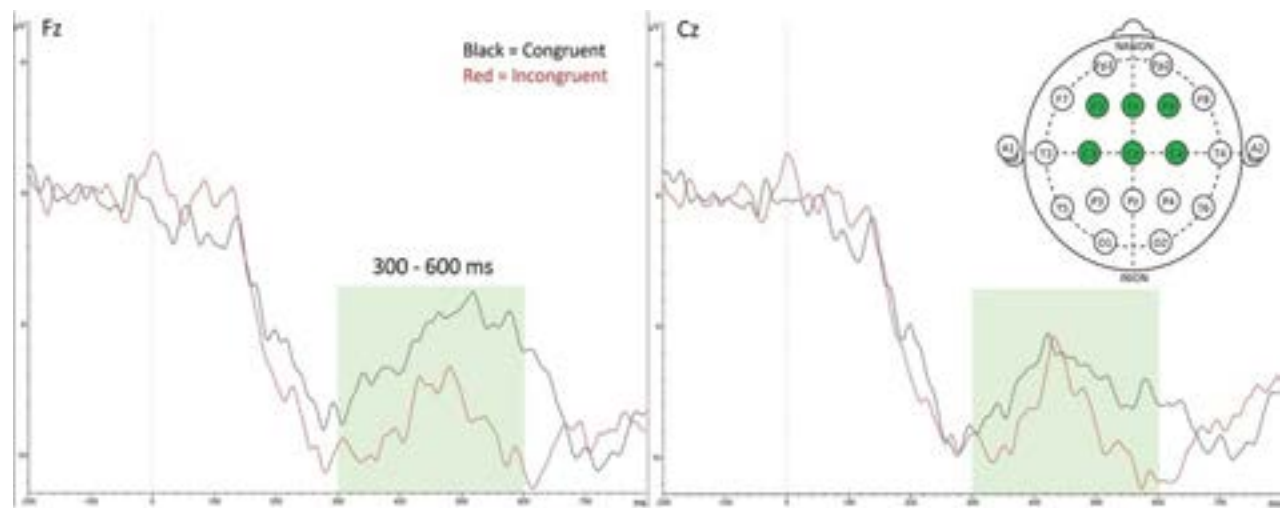
Once the participants were finished running through the study, the research assistants provide the participants with a debriefing form which has the contact information of the lead researcher and further information regarding the study.

Results

We conducted a 2(location: left, right) x 2(time: past, future) repeated-measures ANOVA on recognition accuracy. There was a significant main effect of location, with greater recognition accuracy on the left than on the right. Meaning for trials studied on the left, past items had higher recognition than future items, but for trials studied on the right, future items had higher recognition than past items, which meant our interaction between location and time was significant, $F(1,10) = 9.41, p = .01, \eta^2 = .49$.



In regards to the ERP analysis, we created the grand averages across all subjects for our six electrode sites from our 32 electrode map, which are recognized as F3, F2, F4, C3, C2, C4, and a 300 to 600 millisecond time frame to measure the amplitude of participant's reaction to trials. We then conducted a paired samples *t*-test comparing EEG amplitude on congruent vs. incongruent trials. There was a significant effect, $t(10) = 2.25, p = .049, d = .68$, with more negative N400 amplitude on congruent trials compared to incongruent trials.



Discussion

As our results reflect, participants had more significant N400 amplitudes with congruent trials compared to incongruent trials. Our results showed how the ERP results were significant, but the effect was opposite of our prediction. We expected a stronger N400 signal in incongruent trials than in congruent trials. Instead, we found a stronger N400 signal in congruent trials than in incongruent trials.

Our results from the recognition task highlight how participants did have greater familiarity with information presented which was in congruence with their mental timeline. To further elaborate, participants had greater recognition of information which belonged to David’s past preferences which were presented to them on the left, and similarly, participants had greater recognition of information which belonged to David’s future preferences if it was presented to

them on the right, which supported our hypothesis in participants having greater familiarity and recognition in trials congruent to their mental timeline.

However, the small sample size limits our confidence in this finding. In a larger replication of the recognition task with $N = 78$, the interaction between location and side was non-significant, which is why we acknowledge that our small sample size only reflects tentative effects. We hypothesized that a possible explanation for this finding can be traced back to the sample size we used, and how our protocol may have been interpreted by participants.

Our understanding of the mental timeline is heavily dependent on the research conducted by prominent researchers within this field. Previous research has established its existence, how it functions, and whether it’s dependent on the language you were taught to read and write in. Our study, and its results, are partially supported through the application of previous research. Our research is supported because our results do support our understanding based on previous research, which is that participants do have greater familiarity with trials which are congruent to their mental timeline. However, not all of our findings are supported. Within our ERP trials, we expected to see greater amplitudes of N400 within incongruent trials. We had this expectation based on our understanding that N400 measures participants' “shock” reaction to unfamiliar or incongruent stimuli, which is an idea established from previous studies. Whereas, our study showed that participants had higher amplitudes of N400 in congruent trials, which is not congruent with what has been established through previous studies, which is what shaped our understanding.

We also would like to acknowledge how the large number of subjects excluded due to artifact rejection could be identified as the largest contributor to our limited sample size. Because our ERP procedure included speech, which involves muscle movement, we recognized that participants had difficulty in following instructions when being promoted to wait during the recognition task, which in turn contaminated our data, which in result made it unusable for

analysis. We hypothesize that artifact rejection could be reduced with improvements to the experimental procedure to limit speech and movement when viewing the recognition items. It is also possible that our results are due to a Type 1 error.

Previous research has established our understanding that, to some extent, the mental time does influence memory. We also have an understanding that our timelines are congruent to the direction we are taught to read and write in, which in turn reflects that, cross-culturally, individuals will have different directions in which their mental timelines have been established. Having these ideas established is crucial because of the world we currently live in. In a multicultural, multilingual society and world, understanding how our cognitive processes can be influenced by something as simple as our reading direction and the languages we speak, is important when it comes to contributing to our ability in creating more mindful attitudes towards cultures and cognitive processes which differ from Western ways. .

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Thomas Jacob Bridging the Gap: A Comparative Analysis of Financial and Intersectional Challenges at CSU and UC HSI Institutions

Abstract

The prevalence of low graduation rates and high retention rates within the CSU system can be largely attributed to the financial circumstances faced by many students, especially those belonging to minorities. Previous research has honed in on factors such as academic GPA, SAT scores, and student absenteeism when determining student success by mainly relying on nationwide longitudinal surveys focusing on numerical values that fail to point to critical information such as intersectional elements. This has made it impossible to evaluate factors such as racial wealth gaps, jarring campus cultures, and remedial education challenges faced by students from minoritized students. We use recent data from both the CSU Institutional Data Dashboards and the UC Institutional Databases to compare the different factors that contribute to the respective graduation and retention rates within Hispanic-serving institutions, extrapolating factors that may be changed or improved to better the graduation and retention rates within Cal Poly Pomona. Furthermore, through sampling and surveys evaluating the different financial, SES, and demographic data from various students, we may be able to better devise a solution(s) for the present issue. With the findings we have obtained thus far, providing students with more opportunities to meet with advisors for data-driven decision-making, financial education clubs, financial aid awards, scholarships for financial education, and personal financial education classes would all give them the chance to increase their financial literacy and obtain more funding for their studies, which in turn would bolster productivity and interactivity within these college campuses.

Keywords: *servingness, content analysis, coding, Hispanic-Serving Institutions, Hispanic education, higher education, Latinx/e, graduation, retention, identity, intersectionality, campus-receptive culture, HSI funds, equity gaps, financial literacy, sense-of-belonging*

The following study aims to understand and analyze student success data among Hispanic-serving institutions (HSIs) in California public 4-year universities. Consequently, it is necessary to review the history, legislature, and other events that lead to the undeniable and essential serving of minoritized students in California's public 4-year higher education institutions, particularly in the serving of Hispanic and Latinx students. In 2016, Hispanic and Latinx individuals composed nearly 40% of California's population. Within this population, only 52% of the population made up public high school graduates, and, of those graduates, 45% were eligible to attend a postsecondary institution in the University of California (UC) system or California State University (CSU) system (Paredes et al., 2021). Overall, in the United States, by 2021, 20.6% of adults age 25 and older with a higher educational degree were Hispanic/Latinx (U.S. Census 2022). The following analysis of Hispanic/Latinx students in California demonstrates the necessity to focus on improving practices at various HSIs and expand those efforts to other postsecondary institutions to increase student success rates of Hispanic/Latinx students.

The serving of Hispanic and Latinx students may first be viewed with the establishment of California’s Master Plan of 1960, encompassing objectives for its three segments of public universities and colleges. The purpose of the Master Plan was to define California’s public higher education systems as well as their objectives in awarding higher education degrees. The California postsecondary education system comprises three higher education segments, which include the California Community Colleges (CCC), the California State University (CSU) system, and the University of California (UC) system. The goals of each public college and university, imposed by the Master Plan, were to increase the accessibility to education and to emphasize the significance of research and higher education instruction. The primary objectives of the Master Plan were to fulfill the needs of the state’s future workforce in various sectors, while also addressing the concerns of higher education institutions and residents interested in pursuing postsecondary degrees. The above-mentioned legislature has been successful in these pursuits; however, not necessarily in addressing diversity and equity issues, as equity gaps in degree attainment among historically underrepresented students, compared to their White and Asian peers, continues to be a persistent issue (Boland et al., 2018).

In terms of resolving the aforementioned equity gaps among historically marginalized students, minority-serving institutions (MSIs) were created to educate students who have been historically legally excluded from higher education institutions and met with other injustices (Núñez et. al., 2016). These minority-serving institutions (MSIs) include Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), and Tribal Colleges and Universities (TCUs) (Boalnd et al., 2018). For the purpose of this study, the focus of the following literature will be on Hispanic-serving institutions in terms of their origins and purpose.

The establishment of HSIs was a result of the Higher Education Act, which authorized the funding of multiple federal aid programs. Enacted in 1965, the Higher Education Act (HEA) endorsed several federally funded programs through the U.S. Department of Education to support students interested in pursuing postsecondary education as well as offering services and support to students with low-income, minoritized, and other disadvantaged backgrounds (Hegji, 2018). Federally funded programs such as the U.S. Department of Education Hispanic-Serving Institutions Grant Programs, are designated to Hispanic-Serving Institutions (HSIs) to support Latinx and Hispanic students. For institutions to be eligible for these grants, they must be an eligible HSI, defined as an institution of higher education with an enrollment of at least 25% full-time Hispanic students (U.S. Department of Education, 2024).

The subsequent review aims to compare student success data from two CSU (California State University) and two UC (University of California) HSI institutions - namely CSU Northridge, Cal Poly Pomona, UC Santa Cruz, and UC Merced - to analyze, assimilate, and address the comparatively low graduation and high retention rates within the California State University system. Our primary goal is to extrapolate possible policy implications that can aid the target demographic in enrolling into and graduating from four-year post-secondary institutions. By analyzing the major and common themes within the literature, we aim to provide insight into various factors that affect undergraduate student graduation and retention, as well as identify any gaps or oversights on behalf of the aforesaid institutions that play into the issue. An extensive portion of the literature review will be dedicated to analyzing themes dealing with campus culture receptivity, student support systems, explicit HSI language within said literature and other written mediums, and equity gaps ubiquitous among minoritized student communities. Special attention will be paid to keywords or ‘codes’ to corroborate and clarify any points made.

Literature Review

The Evolution of Dr. Gina Ann Garcia’s ‘Servingness’ Framework

Our study was guided primarily by the concept of ‘servingness’. A term first coined by Dr. Gina Ann Garcia in 2019, servingness is a concept that offers a multidimensional and conceptual method of understanding how post-secondary institutions can progress from simply enrolling Latinx students and begin serving them in a manner that is conducive to their success. She describes servingness as an ‘elusive’ concept due to the varying needs and diversity of students within HSIs. This means that each student requires a personalized subset of resources and assistance to accommodate their needs and experiences on campus (Garcia et al. 2019). Dr. Garcia’s original framework, while well-intentioned, suffered from heavy defiance by the stipulations placed by both the institutions and the government, as well as its inherently complex nature. According to the Higher Education Act, HSIs are defined as non-profit institutions of higher learning with a full-time equivalent undergraduate student enrollment that is at least 25% Hispanic (U.S. Department of Education, 2024). This made defining the parameters of what constituted servingness difficult because HSIs were characterized solely by threshold requirements of enrolled Latinx/e students along with vague student descriptors that failed to detail the nuances of serving a minoritized population of students. Furthermore, while the

framework emphasized student support in the way of allocation of resources and equity management, it failed to acknowledge the formation of interpersonal relationships between students on campus. This is most keenly demonstrated through the low engagement and attendance at HSI events on campus, as well as the solitary nature of campus culture, which mainly stems from a stigma surrounding minoritized students seeking help. According to HSI leaders at a four-year public HSRI on the West Coast which received its HSI denomination in 2015, “We don’t have any web presence.... [T]he students don’t know each other, there’s no sense of community, there’s no sense of, like, pride with [being in the program].... So we hosted... scholars' events this quarter. All my peer mentors put on events, the purpose was to bring them together, have them meet each other. Our attendance was so low. Our challenge is to incentivize them to want to be even more involved” (Covarrubias et al. 2023).

On Dr. Garcia’s Intersectional Servingness Framework

In 2023, however, Dr. Garcia expanded upon her initial framework and provided a more elaborate approach to servingness. In this improved blueprint, Dr. Garcia denotes the ambiguity of the term “Hispanic”, acknowledging that her initial framework centered around Mexican-Americans and Chicanx/es, and disregarded how other sectors of the Latinx/e community, such as Afro-Latinx/es and Indigenous-Latinx/es, were impacted by HSIs. Furthermore, she marries the concept of intersectionality with servingness, intending to use it as an analytical lens to understand how students experience multiple social identities; more specifically, how systems of oppression and domination stunt equitable experiences and outcomes for people belonging to minoritized communities. In this new framework, she provides three criteria for analyzing intersectional servingness: individual social identities (i.e. gender, national origin, immigration status, language, minority status, class, and race/phenotype), domains of power (in an organizational, representative, intersubjective, and experiential context), and historicity (at the macro level and with an emphasis on interlocking forces that evolve) (Garcia & Cuellar, 2023). Dr. Garcia’s new intersectional servingness framework demonstrates a marked improvement from her previous one, with its newly established specifications providing a more structured configuration for serving minoritized students. Not only does it resolve many of the vague elements from her first framework regarding the target demographic and qualifications for servingness, but it also provides a more inclusive approach to serving students that spotlights cultural identity and the dynamics of institutional vs. individual power.

When applied to a large-scale cohort of students, Dr. Garcia’s intersectional servingness framework serves its intended purpose, giving minoritized students at HSIs the facilities they need for success— not by evaluating traditional performance success metrics, but by honing in on ways that institutions serve Latinx/e students in support of educational achievement. HSIs nationwide are implementing Dr. Garcia’s intersectional servingness framework to improve college outcomes for Latinx/e students by validating their experiences within structures. The overarching objective is to prepare undergraduate students with the facilities they need to

succeed academically and non-academically. An invaluable metric for assessing student success in either domain involves student graduation rates; while they don’t necessarily paint a holistic picture on their own, in conjunction with other factors, they frame an intricate account of the conventional student experience at HSIs. Student graduation rates testify to the adequacy of the servingness framework in HSIs, catalyzing a feedback loop that helps prospective students measure the quality of a school since higher graduation rates may beacon a more committed and supportive academic system.

The Role of Grade Point Averages and Academic Self-concept for URM and Hispanic/Latinx Students

As mentioned above, higher graduation rates can illustrate an institution’s commitment to its students’ success. In past studies, student academic success has been measured by grade-point average, as it has been associated with higher likelihoods of degree completion and an indicator of proficient college preparation. One particular study predicted graduation rates among high-achieving students and at-risk students for first-time, full-time freshman students within their first year in college. The study found students with the best-performing grade-point average after their first year graduated at 84%. Meanwhile, students with the lowest grade-point average at less than 1.93 graduated at 35% (Rogulkin, 2011). These students, who were the best-performing students, were considered the best-prepared students as they had average high school GPAs of 3.84 and the highest standardized test scores in their respective cohorts. It is worth noting students who performed best in the aforementioned study consisted of more than half white non-Pell-grant recipients who were not first-generation students. The same study found that students who were less prepared for college and graduated at lower rates than their peers were mostly historically under-represented students and were of low socioeconomic status (Rogulkin, 2011). These findings were consistent with a different study, which declared lack of college preparation as a “major barrier” for underrepresented students (Johnson, 2019). The previous study also found that these students benefited substantially from university support programs that offered financial aid and financial literacy workshops such as EOP programs (Rogulkin, 2011). Another study found that as freshmen grade-point averages increased, there was a 0.3% higher probability of graduation (Millea et al, 2018). The same study suggested smaller classrooms were also indicators of higher graduation rates, underscoring the potential of receiving support in academia results in a higher likelihood of graduation and retention (Millea et al, 2018). To encapsulate the two studies, higher GPAs in the first year of college and higher college preparation are predominant determining factors in graduation and retention rates among all students. Moreover, both studies suggested university support was essential for student academic success.

Self-concept

Regarding HSIs, these traditional measurements of success, although true in some aspects, were found to be minor indicators of student success for Hispanic/Latinx students in terms of predictions toward college GPA, degree completion, and receiving post-graduate education. Instead, self-perception regarding academic success, particularly for Mexican American students, was closely related to graduation rates and higher GPAs (Creighton 2007).

This self-perception is known as academic self-concept, defined as a student's outlook on their academic capabilities and self-beliefs. Because academic self-concept denotes how a student may perceive themselves in academia and their capabilities, it has a substantial effect on their academic achievements, as it reinforces a positive academic self-perception (Marsh and Martin, 2011). This is especially true for Latinx/Hispanic students (Creighton, 2007).

Inequality and Access

Concerning measurements of student success for historically underrepresented students (URM), a study found that URM students are more likely to have lower cumulative GPAs than their peers, as they face institutional-level inequalities that hinder their academic success. This hindrance is further amplified if the student has intersectional identities, where they may face various forms of oppression and disparity (Whitcomb et al., 2021). Intersectional identities refers to the various identities an individual can hold that have been historically marginalized or have been met with disadvantages due to institutionalized and social inequality. The experiences of injustices and oppression by those who carry more than one of these identities can only be understood in terms of layers rather than a combination (Gopaldas, 2013). Relating back to the first study, the study found it was vital to provide guidance and support to URM students with their potential struggles, as it encourages their perseverance and academic success (Bordes-Edgar, 2011; Whitcomb et al., 2021).

To summarize, although traditional measurements of student success have been fundamental indicators of undergraduate degree completion, these measurements have not been significantly applicable to Hispanic/Latinx students in particular. Instead, academic self-concept has been associated with higher graduation rates, as a student’s self-perception on their academic capabilities and achievements relates to higher grade-point averages and a higher likelihood of graduating. With that, it is important to note the various institutional inequalities Hispanic/Latinx students and other URM students may be facing in addition to other intersectional identities that can hinder their success at higher educational institutions. To combat such inequalities, it is essential Hispanic/Latinx students and other URM students receive university support and intervention with focus on emphasizing college preparation and implementing strategies for positive perspectives on academic self-concept.

The Significance of Financial Aid, Personal Finances, and Institutional Spending on Student Success

Although academic self-concept and support are substantial factors that affect graduation and retention rates, especially among minoritized students, personal circumstances such as financial assistance and financial literacy have also been known to greatly affect student success rates, affecting economically disadvantaged students the most (Creighton, 2007). To understand these effects, it is important to define financial assistance and the types of aid students may receive while attending a two-year or four-year college. Essentially, financial assistance is federally funded aid students receive to help cover the costs of their academically related expenses such as tuition, textbooks, transportation, etc. There are several forms of federally funded financial aid students can apply to receive via the Free Application for Federal Student Aid (FAFSA), which

include grants, scholarships, work-study, and loans (USAGov Types of Student Financial Aid, 2024). In general, receiving financial assistance has shown to affect graduation and retention rates in numerous studies (Ishitanti and DesJardins, 2002; Creighton, 2007; Attewell et al., 2011 Millea et al., 2018). Although financial aid is a defining contributor toward graduation and retention, one study found financial aid and how much financial assistance was awarded to students was not the strongest indicator of degree-completion for four-year universities. Instead, the amount of federal aid awarded was known to be the primary indicator of graduation and retention for two-year universities (Attewell et al., 2011). As for how various types of financial aid can affect graduation and retention rates, one study found grants increased the probability of graduating by about 9%. Meanwhile, loans showed adverse effects on graduation and retention, where both subsidized loans and unsubsidized loans led to decreased probability of graduation (Millea 2018). In addition to the effects of financial aid on degree completion, a study found that financial aid and probabilities of drop out behavior were associated with whether or not students received aid as well as when they received their federal aid (Ishitani and DesJardins, 2002).

In addition to receiving financial aid, students may choose to work to cover additional expenses or use particular personal finance strategies to help pay for their academic costs. In terms of work experiences and behaviors for students employed on or off-campus while attending college, financial aid, particularly receiving federal grants, has been known to reduce work hours and alter when students may work. The following effects are significant as they allow students to increase the amount of time spent toward studying, more opportunities to rest, and attend their scheduled courses. As a result, financial aid and the types of aid awarded to students can significantly affect student success in postsecondary institutions (Broton et al., 2016). It is worth noting that affordability toward a student’s education can affect the time to degree completion, where some students may not be able to afford to be a full-time student, thereby increasing time to degree completion (Bound, 2012).

Personal Finances

Concerning personal circumstances in terms of financial literacy and other related behaviors, personal finance behaviors have been known to affect student success rates. For instance, students with larger amounts of debt are likely to take more than four years to complete their degrees (Letkiewicz, 2014). Moreover, students who have taken personal finance courses have been known to have a higher probability of successfully completing their degrees (Eichelberger et al., 2019). However, one study found that personal finance courses are not entirely significant in their relation to student success markers such as graduation rates. Instead, the study found that students who met with financial counselors who could aid them in their financial behaviors were more likely to finish their degrees within four years (Letkiewicz, 2014).

Institutional-Based Spending Effects

Other than personal financial circumstances, institutional level finances affect graduation and retention student success rates immensely as well. One study that compared several low graduation rate (LGR) institutions with high graduation rate institutions (HGR) found that one attribute to low graduation rates in LGR institutions may be due to institutional spending. To

illustrate, the LGR institutions in this study were spending much less than the national average to help serve their student population, who typically needed greater academic aid in the form of academic preparation programs or other kinds of programs. It should be noted that HGR institutions spend below the national average for each student as well; however, LGR spend less than HGR on academic resources and other kinds of resources for their students (Muraskin and Lee, 2004). In short, the amount of institutional spending per student to meet their academic needs is significant toward student success rates in postsecondary institutions.

The Minoritized Student Experience and Representation Within HSIs

In the context of equity gaps and student success, minoritized student populations continue to face adversity in the face of structural discrimination and deep-seated prejudices. This is especially true for students pursuing a career in the STEM field. At first glance, the STEM experience seems to be neutral and indistinguishable in terms of culture from other fields of study in academia. However, numerous studies have characterized STEM classrooms as ‘chilly’ and uninviting for women and people from minoritized backgrounds. Fields in science and engineering have been plagued with an opulent, hetero-masculine culture that is unwilling to envelop and welcome individuals who don’t fit their narrative. The microaggressions and exclusionary behavior elicited by such a culture stunt the learning process and subsequent engagement in the classroom (Flores et al. 2023). More empirical research has revealed that an absence of peers who share identities with minoritized students can trigger a “social identity threat” - a concern that one might be devalued, mistreated, or excluded in a particular social environment due to their group identities (Spencer et al. 2016). On that same vein, the presence of students from minoritized backgrounds may alter the broader climate and culture within post-secondary institutions. This is especially true for Minority Serving Institutions (MSIs) and HSIs (Hispanic Serving Institutions), where a large portion of the student population come from minoritized backgrounds. African American and Latinx/e students who attend institutions with a larger proportion of minoritized students are less likely to experience discrimination and microaggressions toward African American students are less common in classrooms with greater representation of students of color. These institutions are also more likely to implement culturally relevant teaching practices to generate a sense of belonging and campus-receptive culture (Bowman et al. 2023).

Equity Gaps Among Latinx/e Students at HSIs

Latinx/e students comprise the largest ethnic/racial group enrolled at post-secondary institutions, with a significant percentage enrolling in HSIs - institutions where the student population is at least 25% Latinx/e. Moreover, Latinx/e students generally enter post-secondary institutions with different predispositions than their non-HSI counterparts; This is evident when we realize Latinx/e students enrolling into HSIs are more likely to have uneducated parents, come from low-income backgrounds, and come in as transfer/part-time students (Cuellar, 2014). Despite being more involved in co-curricular activities and the campus culture at HSIs, Latinx/e students continue to demonstrate lower graduation rates than their non-HSI counterparts, a gap that can be partially explained by disparities in institutional selectivity and resources. This fact unveils gaps

in terms of equity of access and overall student success, signaling a need for the funding of additional resources to bolster Latinx/e student success (Cuellar, 2014).

Methodology

The following study implemented a quasi-experimental research design, where such subjects (i.e. the universities selected) of this research were chosen carefully based on the factors described below, rather than based on randomization. Additionally, no manipulations or interventions of the data collected were made where such interventions could potentially aid in the analysis of the effects on graduation and retention rates analyzed in this study. By following a quasi-experimental approach, research on graduation rates and retention rates for the selected universities was feasible as randomization of the various effects on graduation and retention rates in Hispanic Serving Institutions selected would be impractical and unethical (Bickman and Rog, 2008; Levy and Ellis, 2011; Reichardt, 2019).

The primary methodology employed in this study involved a qualitative approach of content and document analysis, enabling us to explore the nuanced dynamics within the Hispanic-serving Institution school sites. Document analysis involves a systematic evaluation of texts to find meaningful and rich data to align the institutional contexts of existing actions or inactions by the school sites of this study (Bowen, 2009). Our core objective was to extract meaning, gain empirical knowledge, and compare the relative efficacy of each school as an HSI. Due to the scope and length of the study, document analysis allowed for the rein-depth review of publicly available information, institutional level data, historical insights, access to HSI grant proposals texts, website content, and university strategic plans, which are all crucial for understanding long-term trends and policies of the institutions (Prior, 2003; Saldaña, 2015).

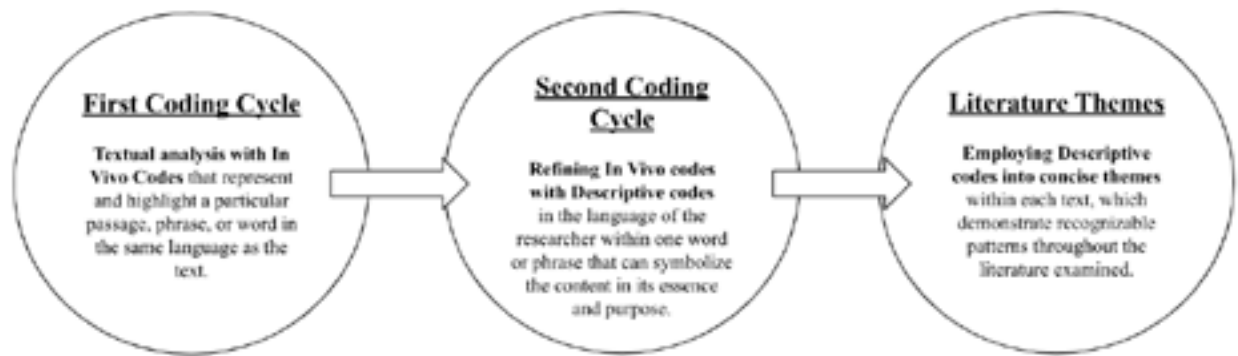
Once document and content data were gathered, we proceeded to conduct our first cycle of coding, where we developed descriptive and in-vivo codes. This gave us the leeway to extract grounded interpretations from textual data allowing for a comparative analysis between institutions and enhancing the reliability and depth of analysis by comparing student success rates, HSI initiatives, existing grant projects, and cultural dimensions of responsivity to their student demographic. These codes were subsequently used to construct themes that could weave a cohesive narrative relaying the efficacy of our selected UCs and CSUs as HSIs. (Saldaña, 2015).

Four school sites were selected in California, each bringing a nuanced understanding of their Hispanic-serving Institution designations and strategies to close achievement gaps and serve minoritized students. UC Santa Cruz, UC Merced, Cal State University Northridge, and Cal Poly Pomona comprising two R1 universities and two state undergraduate and master’s granting universities were selected. Using a quasi-experimental approach, as mentioned above, the selection process of the universities analyzed in this study was based on the following criteria, where each university had to be an eligible Hispanic-Serving Institution, a public four university, and within the California State University (CSU) system or University of California (UC) system. The universities selected were the following: California Polytechnic University, Pomona (CPP); California State

University, Northridge (CSUN); University of California, Santa Cruz (UCSC); and, University of California, Merced (UC Merced).

In terms of how each university was compared following a quasi-experimental research design, the four universities were analyzed on graduation rates among four-year and six-year graduation rates for both general graduation rates, and graduation rates for historically underrepresented students (URM). Graduation rates were used to assess student success at each respective institution. Such metrics have been used in numerous higher education studies to assess a university's qualities and characteristics that have led to degree completion as well as other factors that contribute to this achievement that are not academically focused such as student motivation (Sneyers and De Witte, 2017; Millea, 2018).

FIGURE 1
Title: Simplified Coding Methodology for Qualitat



ive Researchers
Note: A summarized visual representation of Johnny Saldana’s coding methodology that has been employed in this study.

To assess and analyze university characteristics and qualities that contribute to an increase in student success in terms of higher graduation rates, a document analysis was performed using In Vivo and Descriptive coding following Johnny Saldana’s coding methodology for qualitative researchers (Figure 1). The term ‘coding’ or ‘code’ in the context of this research, as well as in the context of Saldana’s, “Coding Manual for Qualitative Researchers,” refers solely to a particular word or phrase that has been constructed for the basis of recognizing certain patterns among the qualities of each university in the document analysis performed (Saldana, 2013). As previously mentioned, a document analysis was performed for the selected universities, where public accessible documents of the universities’ programs, journal articles, mission statements, and other documents were examined. In addition to analyzing HSI grant proposals, the amount of grant funds awarded to each university were calculated by adding the total amount of grants awarded from the National Science Foundation HSI award list from 2022 to 2023 (U.S. Department of Education 2022; 2023). The documents were analyzed using two cycles of

coding. The first cycle involved studying the documents and developing In Vivo codes, where codes are constructed in the same language as the passage to highlight specific words or phrases used. The second cycle refined these codes into Descriptive codes that could represent the essence and purpose of the text. Finally, after analyzing several documents among the various institutions, these Descriptive codes eventually developed into themes or patterns, where such themes were identified within all literature that related back to the objectives of this study i.e. Hispanic-Serving Institutions and student success (Saldana, 2013).

Analysis

A metric we used to gauge HSI efficacy dealt with intersectional servingness. Servingness is at the core of every HSI and offers a multi-dimensional, all-encompassing lens for serving Latinx/e students. The structures of intersectional servingness should be both logistical and adaptive to serve Latinx/e students at the most optimum capacity. These structures are often expressed in an HSI’s mission and purpose statement, grant activities and fund allocations, equity-based leadership practices, communal diversity, institutional policies, and institutional advancements (Garcia, 2019). While many HSIs demonstrate a certain level of intentionality when it comes to serving their Latinx/e student population, they also lack the explicit language and recognition necessary to make their target demographic feel acknowledged. For instance, in Cal Poly Pomona’s mission and purpose statement—

the institution eulogizes its ability to “cultivate success through a diverse culture of experiential learning, discovery, and innovation” and prides its core values of “academic excellence”, “experiential learning”, “student learning and success”, “inclusivity”, “community engagement”, and “social and environmental responsibility” (Mission, Vision, and Values, 2024).

The institution, however, makes no mention of its HSI identity or the Latinx/e community inhabiting its campus. Instead, it speaks predominantly about concepts like inclusivity, student success, and communal engagement. While these values are crucial to uphold, they ultimately provide the reader with no hints as to the flavor of its core identity as an HSI. The sparse instances in which Cal Poly Pomona does address its HSI identity, it only defines the term on an elementary level and doesn’t elaborate on its goals in regard to this identity.

Conversely, UC Merced exclaims a pride in—housing “...a student body that is more than 55 percent Hispanic...”and cultivating a “sense of belonging” that respects and values multiple “cultural and racial experiences and perspectives”. It also states that holding the HSI denomination is about “more than just...numbers and eligibility” (Guerra, 2023).

It considers ‘HSI’ an epithet that places the onus on the institution to develop an intentional focus and generate a campus environment that will be conducive to underrepresented student success.

Similarly to UC Merced, UC Santa Cruz demonstrates a servingness framework by explicitly pronouncing its intentionality toward serving Hispanic/Latinx/e students in both academic and non-academic student success outcomes (Garcia 2019). In 2012, UC Santa Cruz

was eligible to become a Hispanic Serving Institution. In 2015, UCSU applied to numerous federal HSI grants focused on increasing equality and support for Hispanic/Latinx students and other URM students at the university. A document analysis of UCSU was performed and included examining the postsecondary institution’s HSI grant proposals; HSI mission statements and overview; and examining its longest running HSI grant funded program known as Cultivamos Excelencia. In the university’s vision statement for its HSI initiatives—

USCU demonstrates an intentionality of serving Latinx students and identifies clear and specific goals to –“Graduate Latinx and low-income students to support racial equity goals and open academic and career pathways to achieve holistic student success, including a 90% undergraduate graduation rate for native frosh and transfer with a 3.0 or higher grade” (UC Santa Cruz Hispanic Serving Institution Initiatives, 2024).

In its HSI grant initiatives for Cultivamos Excelencia, UCSU not only embraces the usage of Spanish in its program title, but recognizes its leadership as an R1 HSI which, “seeks to create systemic change that will improve...the lives of...local community college Latinx, first-generation and low-income students...” (Cultivamos Excelencia, 2024).

For California State University, Northridge (CSUN), the university displays a form of servingness following Dr. Gina Garcias’s framework in terms of intentionality in both non academic and academic endeavors such as academic persistence, academic self-concept, and other critical indicators of servingness (Garcia, 2019). CSUN is unique from the three other postsecondary institutions as it is currently home to an HSI grant awarding innovation hub known as the Global Hispanic Serving Institution Equity Innovation Hub. The Global HSI Equity Innovation Hub was established in 2021, where CSUN and other HSIs have worked together to mitigate equity gaps among Latinx students and ensured students will have the necessary skills needed for careers in Science, Technology, Engineering, and Mathematics (STEM). When the innovation hub was established, CSUN President Erika D. Beck was supportive and encouraging of the new addition to the campus declaring—

“We aim to shift the conversation away from what students must do to be successful to what our institutions must do to successfully serve our Latinx and other diverse students” (CSUN Today, 2021).

Although innovative in embracing its servingness toward Latinx students, CSUN has yet to model itself as an HSI in its mission statements as well as other academic programs. For instance, in its mission statement –

“California State University, Northridge exists to enable students to realize their educational goals...we design programs and activities to help students develop the academic competencies, professional skills, critical and creative abilities, and ethical values of learned persons who live in a democratic society...” CSUN does not present itself as an HSI (CSUN Mission, Values, and Vision, 2024).

Upon further analysis of its academic programs, CSUN did not represent any specifically related HSI student success themes in its various established academic programs such as the TRIO programs it sponsors (CSUN Division of Student Affairs TRIO, 2024) and Academic First Year

Experiences courses (CSUN Academic First Year Experience, 2024). However, the programs previously mentioned do demonstrate Dr. Garcia’s servingness in terms of academic persistence, academic self-concept, and other factors, although not explicitly mentioned toward Hispanic/Latinx students.

As per the published literature, the HSI identities of CSUs like Cal Poly Pomona and CSU Northridge and UCs like UC Merced and UC Santa Cruz demonstrate a stark dichotomy that can be traced back to student incentivization and overall intentionality. The UC HSI Initiative was launched in 2018 (Paredes et al. 2021) while the CSU HSI Initiative was launched in 2004 (A California Briefing on 25 Years of HSIs, 2021). Despite holding the HSI denomination for longer, CSUs seem to have a less developed HSI identity when compared to their UC counterparts. To accentuate this point further, on average, Latinx/e students account for 22.5% of the student population at UCs (UC Office of the President, 2023) and over 48% of the student population at CSUs (The CSU System, 2023). Furthermore, UCs house over 113,000 students or about 38% of their student population (Overview of University-Provided Student Housing, 2023) while CSUs only house about 9% of their student population (Student Life, 2024). Despite having a substantially smaller Latinx/e community, UCs still manage to foster a more active HSI student community. While this can be partly attributed to CSUs enrolling more commuter students relative to its overall student population, it mainly revolves around student incentivization by student groups and the institutions themselves.

FIGURE 2
Title: Latinx/e Student Headcount and Percentages within the CSU and UC Systems

	CSU System	UC System
Latinx/e Student Percentage	48.3%	22.5%
Latinx/e Student Headcount	219,747	61,075

Note: Headcount and percentage of Latinx/e students enrolled within the CSU and UC systems relative to the overall student population (UC Office of the President, 2023; The CSU System, 2023).

Gradation Rates and Equity Gaps

After examining each universities’ graduation rates for first-time freshmen for both four-year and six-year graduation rates, this distinct dichotomy between CSUs and UCs is further emphasized.

For instance, graduation rates among the UC HSIs selected were larger compared to the CSU HSIs selected.

FIGURE 3
Title: Overall Graduation Rates for both UC and CSU Institutions

	4-Year Graduation Rates	6-Year Graduation Rates
UC Santa Cruz	62.6%	77.5%
UC Merced	54%	74%
Cal State Northridge	29.1%	66.7%
Cal Poly Pomona	25.0%	56.2%

Note: Graduation rates for the selected HSIs in the UC and CSU system for 4-year and 6-year graduation rates for the general student population for the 2017 cohort (University of California Undergraduate Rates, 2024; The California State University Graduation and Continuation Rates, 2024).

In 2017, overall graduation rates for UC Santa Cruz and UC merced for four-year and six-year degree completion rates were higher than that of Cal State Northridge and Cal Poly Pomona where graduation rates for four-year completion was below 30%. For six-year graduation rates, CSU HSIs degree completion rates were higher from their four-year graduation rates as was the case for the UC HSIs (Figure 3).

FIGURE 4
Title: Historically Underrepresented Students (URM) Graduation Rates for both UC and CSU Institutions

	4-Year Graduation Rates	6-Year Graduation Rates
UC Santa Cruz	57.0%	73.0%
UC Merced	50%	66%
Cal State Northridge	21.8%	60%
Cal Poly Pomona	20.3%	51.7%

Note: Graduation rates for the selected HSIs in the UC and CSU system for 4-year and 6-year graduation rates for historically underrepresented students for the 2017 cohort (University of California Undergraduate Rates, 2024; The California State University Graduation and Continuation Rates, 2024).

FIGURE 5
Title: Percentage Equity Gaps in Graduation Rates for both UC and CSU Institutions

	4-Year Graduation Rates Gap	6-Year Graduation Rates Gap
UC Santa Cruz	5.6%	4.5%
UC Merced	4%	8%
Cal State Northridge	7.3%	6.7%
Cal Poly Pomona	4.7%	4.5%

Note: Figure 3: Percentage equity gaps for each respective HSI between overall graduation rates and graduation rates for historically underrepresented students, which was calculated by subtracting graduation rates for URM students from the overall graduation rates for the 2017 cohort (University of California Undergraduate Rates, 2024; The California State University Graduation and Continuation Rates, 2024).

URM graduation rates for all HSIs were generally lower than overall graduation rates for both four-year and six-year graduation rates (Figure 4), as demonstrated by the following percentage equity gaps (Figure 5). Although lower from overall graduation rates, degree completion rates for UC HSIs were higher compared to CSU HSIs for URM students for both four-year and six-year graduation rates and fell above 50%. Meanwhile, graduation rates for CSU HSIs were lower compared to UC HSIs and fell above 20% (Figure 4). In terms of percentage equity gaps, equity gaps existed among all institutions exhibiting an existence of inequality between URM students and non-URM students. As a result, such equity gaps demonstrate a need for change and intervention in student success for minoritized students.

Intentionality to Serve Latinx Students

Upon analyzing the NSF HSI awards list (2022-2023) for each of the aforementioned institutions, we were able to make conclusions regarding the allocation of HSI funds and institutional incentivization. The project abstracts produced by Cal Poly Pomona sought to improve the academic and non-academic aspects of the student experience through reforms in the curriculum to close achievement gaps, as well as strategies to bolster diversity and

participation. Projects like Bridging Institutions to Decrease Gaps in Engineering Education' and Closing Achievement Gaps in Core Undergraduate Civil Engineering Courses—
focused on “improvement of student outcomes”, “mitigation of equity gaps”, and “increasing student success” via reformation of STEM-related courses like engineering. Other projects like Collaborative Research: Broadening Inclusive Participation in Artificial Intelligence Undergraduate Education for Social Good Using A Situated Learning Approach and HSI Institutional Transformation Project: Cal Poly Pomona Intentional Venture Engaging STEM Students (CPP INVESTS)—
featured terms like “diversity, equity, and inclusion”, “sense of belonging”, “academic self-efficacy”, and “social issues” to underscore their focus on social issues within the Latinx/e community.

In total, Cal Poly Pomona received \$6,529,988 in HSI award funds for the fiscal year 2022-2023—more than any of the analyzed institutions.

Correspondingly, HSI grant abstracts for Cal State Northridge recognize the hardships and barriers minoritized students may face while attending university, and aim to close equity gaps among minoritized students pursuing Science, Technology, Engineering, and Mathematic (STEM) degrees. For instance, projects such as the HSI Planning Project: START—
recognizes two-year institutions as key access postsecondary institutions for URM students, particularly for “Latinx, low-income, and first generation college students.” The project acknowledges these students can experience shifts in their perceptions of academia and how it may relate to “a shift in cultural norms and values aligned with middle-class contexts,” which may lead to feelings of “reduced academic belonging, performance and persistence, particularly for students in STEM majors.”

The program aims to enhance first-year STEM transfer student experiences at CSUN by removing cultural and institutional barriers. In addition, the project, HSI Institutional Transformation Project: Creating Opportunities for Minoritized Students to Participate in Faculty Mentored Research, plan to establish the training hub ESTUDIO: Excellence in Student Training for Undergraduates, Diversity Initiative Office at the California State University, Northridge. With the establishment of this training hub, the project aims to provide support and mentorship through opportunities of undergraduate research to minoritized students in order to eliminate equity gaps and expand their efforts to other HSIs.

Other programs, such as the program, Enhancing Access to STEM Careers by Facilitating Transitions from Course-based Internship-based Undergraduate Research Experiences, do not directly mention Latinx students, nor minoritized students; however, the project does describe its objectives to become an inclusive and supportive program that helps its students transition into internship-based research.

One particular characteristic which makes CSUN unique from the other aforementioned institutions is the establishment of the Resource Hub: The NSF National Resource Hub for STEM Education at Hispanic-Serving Institutions. The primary purpose of the following project focuses on expanding their resources to other HSIs in the nation by providing opportunities for

training and mentorship on grant-writing proposals; obtaining funding for STEM research; supplying education on issues relevant to the STEM field; and equip HSIs with inclusive teaching practices to increase student success rates. The funding CSUN received for the previously mentioned HSI programs and projects was a total of \$3,588,617 in grant awards, which was the second most funding awarded among the four institutions analyzed.

The second to last HSI institution to receive the lowest HSI grant award funding among the universities examined in this study was UC Santa Cruz, which received \$2,897,374 in HSI grant awards. The grant abstracts and proposals for the various programs established at UC Santa Cruz intend to expand opportunities in STEM for students to participate in undergraduate research and internships. This is the main objective of the project, Implementation and Evaluation of Curricular Undergraduate Research Experiences in the Life Sciences, which seeks to increase participation in STEM at HSIs. Other projects such as, FuSe-TG: Co-designing Novel Memristor Heterostructures for Brain Inspired Computers, and, Implementation and Evaluation of Curricular Undergraduate Research Experiences in the Life Sciences, do not explicitly state how these projects may aid their Hispanic/Latinx student population. Instead, they imply their services will aid students in their success while attending UC Santa Cruz. Another project that was deemed appropriate to receive HSI funding at UC Santa Cruz from 2022 to 2023 was Field-based Undergraduate Training: Utilizing Research for Equity (FUTURE) in Biology. The project plans to understand the elements of field STEM courses to improve student success metrics with emphasis on improving these metrics for minoritized students.

Likewise, UC Merced’s project abstracts focused on reforming and making addendums to STEM courses in order to aid underrepresented students academically. The UC Merced STEM Summer Start project abstract—

focused on providing “underrepresented minorities, first-generation and Pell-eligible STEM students who persist in their STEM major” with “accessible...high-quality...experiences" to help students succeed academically and foster a “sense of self-belonging”, “resilience”, and “self-efficacy”.

By providing underrepresented students with extracurricular and intracurricular activities, the project aims to build a sense of belonging and community within students who would typically feel excluded from the larger campus culture. Similarly, the Building Capacity: Improving the Undergraduate Chemistry Experience by Green Chemistry, Active-learning, and Peer-led Experiences project abstract—

aimed to help underrepresented STEM students by increasing undergraduate interest in chemistry through a redesign of the chemistry laboratory courses by developing videos in “both English and students' native languages.”

By modifying the current systems in place in order to accommodate essential aspects of students’ cultures, the project acknowledges underrepresented students and makes them feel like they are being served at the institutional level. In total, UC Merced received \$1,942,497 in HSI award funds for the fiscal year 2022-2023 (U.S. Department of Education, 2022; 2023).

Discussion

Our literary analysis revealed a divergence in the development of the HSI identities between CSUs and UCs. Despite holding the HSI title for a more extended period of time and having a larger Latinx/e student demographic, CSUs demonstrate a relative lack of intentionality and student incentivization within their literature, as well as within HSI-related activities. This is especially telling when we take into account that CSUs receive a large portion of HSI-related award funds from the NSF.

These findings gave us the cognisance we needed to determine the different components that constituted an “ideal HSI”. These components include an explicit focus on intentionality, a well-developed servingness framework, the fosterment of an inclusive receptive culture, and resources for academic support. This is in accordance with previous studies on HSI grant fund usage and the importance of allocating funds from Title V to training and professional development, long-term initiatives for establishing racial justice in the classroom, advancing diversity, equity, and inclusion (DEI) efforts on campus, and empowering grassroot leadership - all of which promote the efficacy of servingness through HSI-related activites (Petrov & Garcia 2021).

Policy Implications

From our established HSI qualifiers, we developed policy implications to alleviate the ongoing issues at HSIs. They include the recruitment of larger HSI-dedicated staff, the widespread use of campus receptive language in literature, an increased focus on fostering a campus-receptive culture over academic achievement, the development of strategies address and/or close the equity gaps at HSIs, and courses/workshops to inform and assist students in their financial struggles. These policy implications would remedy issues dealing with developing a more distinct HSI identity, increasing student engagement with HSI-related activities, building a more cohesive sense of community on campus, and serving Latinx/e students in the most optimal manner possible. Previously proposed frameworks reimagine HSIs in much the same way, with an aim to manufacture a universal definition for the term HSRI, create actionable goals in line with the HSI mission, increase Latinx/e student support and incentives for research, hire and retain more Latinx/e faculty, establish a diversity staff/faculty taskforce, and develop more articulate standardized measures for evaluating HSRI (Cuellar et al. 2023).

Limitations

While we sought to evaluate various factors contributing to Latinx/e student success at CSU and UC HSIs by sifting through graduation and retention rate data and ardently criticizing the servingness framework, there were gaps in our research that limited the efficacy of our study. For instance, our study relied mainly on information available from databases and previously conducted research. Empirically, we could have improved our approach by surveying/interviewing students with questions tailored to obtain information relevant to factors that affect graduation/retention. Our study could have further benefited from a more extended analysis of the literature to identify more themes and codewords related to HSI success. Lastly, expanding the research past UCs and CSUs to analyze other HSI institutions would have given us a better grasp of the issue at the national level. Analyzing other HSIs, as well as MSIs, would

have allowed us to make more conclusive determinations regarding the gaps present within these institutions, making our proposed policy implications more applicable.

Conclusion

The concept of policy implementation extends far beyond any governmental or institutional scope; it is also a responsibility vested within HSI leaders and advocates. In hindsight, graduation and retention rates are only able to scratch the surface of the issues afflicting HSIs. To develop a more nuanced understanding of these issues, institutions and HSI leaders must holistically review their current servingness strategies and work towards better serving their Latinx/e student populations. With our proposed policy implications, we challenge the HSIs within the CSU and UC systems to take strides towards developing more perceptible HSI identities, fostering a campus-receptive culture that values academic and non-academic achievement in equal capacity, informing students of relevant social issues, and building a cohesive sense of community and belonging - all of which contribute towards building an effective servingness framework.

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Thomas Jacob

Unlicensed Corrections Violate the Gricean Maxims of Communication: Evidence for a Cognitive Mechanism Underlying Misinformation Backfire Effects

Abstract

Misinformation has become commonplace in today’s society due to the decentralization of media and the incredible speed with which information spreads. As such, the correction of misinformation has become a salient topic for news outlets, cognitive scientists and the broader public. Unfortunately, once misinformation has been disseminated, it has proven very difficult to correct. A primary concern when attempting to correct misinformation is potential backfire effects. This occurs when an individual’s belief in misinformation is increased rather than decreased as a result of corrections to misinformation. This study investigated the effect of licensing on the presence of backfire effects. Participants were presented with text messages in which a novel word was used either within the context of a sentence (i.e., “I drive really fast in my vompa”) or not at all. A second text message then negated the meaning of the novel word (i.e., “vompa does not mean car”) or was not presented. After each set of text messages, participants were asked to report what they believed the meaning of the novel word to be. Data analysis revealed that corrections to unlicensed misinformation increased belief whereas corrections to licensed misinformation decreased belief demonstrating that a backfire effect occurred as a result of unlicensed negated correction. We posit that the backfire effect observed in this study is the result of a violation of the Gricean maxims of communication, and that this mechanism may shine a light on the present uncertainty surrounding the existence of backfire effects when correcting misinformation.

In the age of the internet, public discourse is continually inundated with conflicting sources of information, and the speed at which this information spreads throughout society has surpassed our ability to control its flow. As such, the spread of misinformation (i.e., incorrect information) has become an unavoidable issue. As conventional news outlets struggle to keep up with the spread of information through the internet, they have attempted to correct misinformation as it becomes available. This has led to an abundance of conflicting information available to the public and has increased confusion about the credibility of news sources (Haas & Wearden, 2003). Moreover, this has uncovered a lack of consensus on how best to mitigate the issue of misinformation and has led to many cognitive scientists weighing in on the most effective way to correct it (Cook et al., 2014; Lewandowsky et al., 2012; Walter et al., 2021).

While various strategies have emerged for slowing the spread of misinformation – such as including fact-checking warning labels and removing social endorsement cues on fake news media – research on the effectiveness of these methods of misinformation correction is either contradictory or tentative (Clayton et al., 2020; Ecker et al., 2020b; Kemp et al., 2022b; Koch et al., 2023; Oeldorf-Hirsch et al., 2020; Pennycook et al., 2020; Schul, 1993; Skurnik et al., 2005). Although explicit correction and refutation have been shown to be an effective strategy for lowering belief in misinformation (Cameron et al., 2013; Cook et al., 2014; Kowalski & Taylor, 2009; Paynter et al., 2019; Van Boekel et al., 2017), misinformation tends to influence decision-making even after it has been explicitly corrected – termed the continued influence effect (Johnson & Seifert, 1994).

Emerging from literature regarding the effect of inadmissible evidence on jurors’ decision-making (Carretta & Moreland, 1983), the perseverance of social judgments based on corrected information (Ross et al., 1975; Wyer & Budesheim, 1987), and the editing of episodic memories (Wilkes & Leatherbarrow, 1988), Johnson and Seifert (1994) formalized the continued influence effect in cognitive psychology by using the warehouse paradigm to demonstrate that false information continues to influence decision-making even after it has been explicitly corrected. The continued influence effect has been thoroughly demonstrated and remains a concern in the field of misinformation correction (Ecker et al., 2010; Ecker et al., 2011a; Ecker et al., 2011b; Gordon et al., 2017; Gordon et al., 2019; Guillory & Geraci, 2016; Rich & Zaragoza, 2016; Rich et al., 2022). This memory error has proven incredibly difficult to mitigate. Neither increasing the number of corrective repetitions (Ecker et al., 2011b) nor educating participants about the continued influence effect itself (Ecker et al., 2010) completely eliminates the persistence of misinformation after correction. Further, some research has found that, under certain conditions, corrections to misinformation may backfire and actually increase reliance on that misinformation (Autry & Duarte, 2021; Berinsky, 2015; Nyhan & Reifler, 2010).

Two mechanisms have been proposed to explain the occurrence of possible backfire effects: the *worldview backfire effect* and the *familiarity backfire effect*. Some evidence for a *worldview backfire effect* – where corrections that contradict an individual’s strongly held beliefs about the world cause an unintended increase in their belief of that misinformation – has been observed (Nyhan & Reifler, 2010; Nyhan et al. 2013, Lewandowsky et al., 2005). However, rigorous continued investigation has failed repeatedly to replicate the effect (Ecker & Ang 2018; Ecker et al. 2014; Ecker et al. 2021; Guess & Coppock, 2018; Haglin 2017; Wood & Porter, 2019; for a review, see Swire-Thompson et al., 2020). On the other hand, the *familiarity backfire*

effect is suspected to be caused by the repetition of misinformation during its correction (Lewandowsky et al., 2012; Schwarz et al., 2007). This repetition both necessarily increases the strength of the memory associated with the misinformation and increases the familiarity an individual feels with that misinformation. Familiarity by means of repetition has long been associated with the assumption of truth, termed the illusory truth effect (Allport & Lepkin, 1945; Hasher et al., 1977) – likely caused by an increase in the processing fluency associated with that information (Berinsky, 2015; Schwarz et al., 2007). Thus, as information becomes easier to process through repeated exposure (i.e., increasing familiarity), individuals perceive that information as more truthful.

Evidence of the *familiarity backfire effect* is contradictory. While some studies demonstrate more use of misinformation following a correction due to an increase in familiarity (Autry & Duarte, 2021; Berinsky, 2015; Peter & Koch, 2015; Skurnik et al., 2005), others have either found no such evidence (Ecker et al., 2020a, 2020b; Ecker et al., 2023; Prike et al., 2023; Swire et al. 2017) or have found that the familiarity effect actually increases the effectiveness of corrections rather than facilitating a *familiarity backfire effect* (Ecker et al., 2017; Kemp et al., 2022a; Wahlheim et al., 2020). Moreover, Swire-Thompson et al. (2022) found that familiarity backfire effects were strongly negatively correlated with item reliability – indicating a potential mechanism for the discovery of false-positive familiarity backfire effects. This lack of consensus demonstrates a need for further investigation into the existence of the *familiarity backfire effect* and the specific conditions under which it may occur.

In one account of the *familiarity backfire effect*, Autry and Duarte (2021) showed evidence of a backfire effect occurring under the condition of *unlicensed* negated correction. Licensing is a linguistic concept that states that one piece of information may justify the

statement of another. Prior knowledge, conversational context, or preconceived assumptions may also justify the statement of certain information. For example, in a conversation about the weather, “my car is the red one,” would be an unlicensed statement since there is no context to justify the conveyance of that information. A statement like this violates the Gricean maxims of communication (Grice, 1975). The Gricean maxims outline a system of assumptions typically used during cooperative communication. According to Grice, given that cooperative communication is occurring, recipients of information assume – and will go to great lengths to justify the assumption – that information is truthful (maxim of quality), informative (maxim of quantity), relevant (maxim of relation), and stated clearly (maxim of manner).

Importantly, “flouting” a maxim occurs when a maxim is violated on the surface, but the recipient justifies the violation by assuming that the maxim was still obeyed on a deeper level (Grice, 1975). This assumption underlies most figures of speech used in common communication (e.g., assuming that “break a leg” is intended to mean “good luck” rather than its literal meaning). Autry and Levine (2012, 2014) demonstrated that the unlicensed negation of information caused an increase in the salience of that information relative to non-negated information. Building on the pragmatic inference hypothesis proposed by Levine and Hagaman (2008), Autry and Levine proposed that a violation of the Gricean maxims of communication may underlie this effect. In the case of unlicensed negated correction, the maxim of relation is being violated, which states that information should be relevant to the current exchange. When given information that is not apparently relevant, recipients tend to first assume that the information is still somehow relevant (i.e., that the speaker is “flouting” the Gricean maxim of relation) and begin to generate inferences to explain why the information was provided. Autry and Levine claim that these inferences were responsible for the increase in the salience of the

information being negated in their studies. It’s possible that this mechanism may also underlie the occurrence of a backfire effect when presenting participants with misinformation in unlicensed conditions.

In Autry and Duarte’s (2021) study, when participants were presented with only negated corrections (i.e., unlicensed correction) to misinformation (e.g., “...the car was *not* blue”), they were more likely to rely on the misinformation (i.e., reporting that the car *was* blue) than when they had not received any information at all (e.g., “...the car was his neighbor’s new vehicle”). Although the effect was not statistically significant in a second experiment including a wider range of passages, the general uncertainty surrounding *familiarity backfire effects* in the literature calls for further investigation into the prospect of licensing underlying the presence of backfire effects.

Prike et al. (2023) consequently sought to replicate the findings of Autry and Duarte (2021). They conducted three experiments using unlicensed corrections which included a conceptual replication of Autry and Duarte’s experiment 2 (experiment 1), the addition of a one-week delay condition (experiment 2), and an analysis of the impact of participant’s skepticism regarding source credibility of the correction (experiment 3). In all but the high-skepticism condition of experiment 3, no evidence of a backfire effect was found. Prike et al. tentatively attributed the discrepancy between the findings of Autry and Duarte and previous literature (Ecker et al., 2017; Ecker et al., 2020a, 2020b; Ecker et al., 2023; Kemp et al., 2022a; Swire et al. 2017; Wahlheim et al., 2020) to a violation of Gricean maxims of communication (Grice, 1975). That is, the oddness of the corrections presented in Autry and Duarte’s study “[led] participants to infer that there are unmentioned reasons to believe the misinformation or to be skeptical of the correction” (Prike et al., 2023, p. 3).

The present study seeks to further this line of reasoning by maximizing the influence of the violation of Gricean maxims present in the unlicensed corrections used. We posit that because unlicensed corrections violate the Gricean maxims by definition, maximizing the influence of those violations (i.e., making the violations as overt as possible) will maximize the backfire effect observed as a result of the unlicensed corrections. To achieve this, instead of presenting participants with complete passages of events as in previous literature (Autry & Duarte 2021; Autry & Levine, 2014; Levine and Hagaman, 2008; Prike et al., 2023), we will use brief text message conversations to convey information about the meaning of a novel word. A similarly brief method of presenting misinformation was used in Flores and Autry’s (2021a, 2021b) studies which also found that a backfire effect occurred as a result of unlicensed corrections. This change removes the context which justified the correction of misinformation in previous literature and thus maximizes the influence of the violation of Gricean maxims in the unlicensed corrections presented to participants.

We will analyze the effect that the licensing (i.e., licensed vs. unlicensed) and correction (i.e., corrected vs. uncorrected) of misinformation have on participants’ use of that misinformation in response to open-ended questions. In keeping with previous literature on the *continued influence effect* (Ecker et al., 2010; Ecker et al., 2011a, 2011b; Gordon et al., 2017; Gordon et al., 2019; Guillory & Geraci, 2016; Rich & Zaragoza, 2016; Rich et al., 2022), we hypothesize that misinformation use will be lower in the licensed corrected condition than in the licensed uncorrected condition, but will be significantly higher than in the unlicensed uncorrected condition where no information is given to participants. Further, we hypothesize that in the licensed conditions, misinformation use will be lower in the corrected condition than in the uncorrected condition, demonstrating that licensed corrections *decreased* misinformation use.

However, in the unlicensed conditions, we hypothesize that misinformation use will be greater in the corrected condition than in the uncorrected condition, demonstrating that the unlicensed corrections *increased* misinformation use.

Method

Participants

A priori power analysis (G*Power 3; Faul et al., 2007) suggested a minimum sample size of 129 subjects to detect a medium-sized effect, $f = 0.25$, with 80% power. Data was collected from 169 students between the ages of 18 and 49 ($M_{age} = 22.14$, $SD = 5.14$) who signed up for the study. The sample included 125 females, 36 males, 3 non-binary/third-gender individuals, and 1 gender-fluid individual. 4 participants did not report their gender. The sample was constructed using self-selected participants who needed research participation credits for their undergraduate classes. Students were awarded .75 Sona credits (37.5% of the minimum requirement for classes that require research participation) for their participation in this study.

Materials

Items included 75 text message conversations that contained various amounts of information regarding the meaning of a novel word used within the messages. Licensed items included a message that used the novel word within a sentence such that the meaning of the word was relatively easy to infer (e.g., “My uniom just learned how to use the litter box”). Items in the unlicensed condition did not include this message. Corrected items included a message that negated the information given in the licensed condition (e.g., “Uniom does not mean cat.”). Uncorrected items did not include this message. Additionally, 15 “filler” items included an affirmative expression of the meaning of the novel word (e.g. “Uniom means umbrella.”) to avoid response fatigue and provide a baseline for judging participant’s engagement with the task.

In 10 of the filler items, the affirmative expression of the meaning of the novel word was different from the meaning inferred from the licensing message; whereas in the other 5 filler items, a correction was not given, and the affirmative expression of the meaning of the novel word aligned with the meaning inferred from the licensing message.

Items were counterbalanced such that each subject saw 15 items in each of the four conditions (15 licensed corrected, 15 unlicensed corrected, 15 licensed uncorrected, and 15 unlicensed uncorrected) and each item appeared in all four conditions across subjects. “Filler” items were not counterbalanced. For each condition, items were randomly presented with either green or blue messages to provide some visual variety for participants during the task (see Figure 1).



Figure 1. Sample item in all four experimental conditions. A represents the licensed corrected condition, B represents the licensed uncorrected condition, C represents the unlicensed corrected condition, and D represents the unlicensed uncorrected condition.

Procedures

Participants signed up for the study online using the Sona participant pool management system and received a link to the Qualtrics survey. Participants read and signed a consent form and then read the instructions for the study task. Example items and responses were given. Next, participants were presented with 75 items one at a time and in random order. After each text message image, subjects were asked what they thought the novel word meant and wrote their answer in a free-response short-answer text box. Items and response entries were on separate pages such that participants could not refer back to the items when typing their responses. Participants reported their age and gender after completing all 75 trials. Participants were then presented with the debrief form before being redirected back to the Sona system to be assigned credit. The study took about 30 minutes to complete.

Results

This study used a within-subject 2x2 factorial design. Factors included licensing (licensed vs. unlicensed) and correction (corrected vs. uncorrected). Responses were coded by the first author as either containing the misinformation word or not containing the misinformation word. For example, in a trial where “My mom made me a peanut butter and jelly jommro for lunch” was the misinformation, responses including “sandwich” were marked as containing misinformation. Responses negating the misinformation word (e.g., “not sandwich”) were marked as not containing misinformation. A filler accuracy of 60% (i.e., 9 out of 15 correct) was selected a priori as the cutoff for usable participant data. Participants with a filler accuracy of less than 60% were excluded from data analysis (28 participants) yielding an effective sample size of 141.

The remaining data were analyzed through a 2x2 repeated measures ANOVA using IBM SPSS Statistics (Version 27) with $\alpha = .05$. The test revealed a significant interaction effect between licensing and correction, $F(1, 140) = 1697.07, p < .001, \eta_p^2 = .92$. More misinformation belief was reported in the licensed uncorrected condition ($M = .78, SD = .01$) than in the licensed corrected condition ($M = .20, SD = .02$) whereas less misinformation was reported in the unlicensed uncorrected condition ($M = .00, SD = .00$) than in the unlicensed corrected condition ($M = .14, SD = .02$). Means and standard errors are presented in Figure 2. The main effects were also significant with licensing affecting misinformation belief, $F(1, 140) = 1903.61, p < .001, \eta_p^2 = .93$, and correction affecting misinformation belief, $F(1, 140) = 110.39, p < .001, \eta_p^2 = .44$.

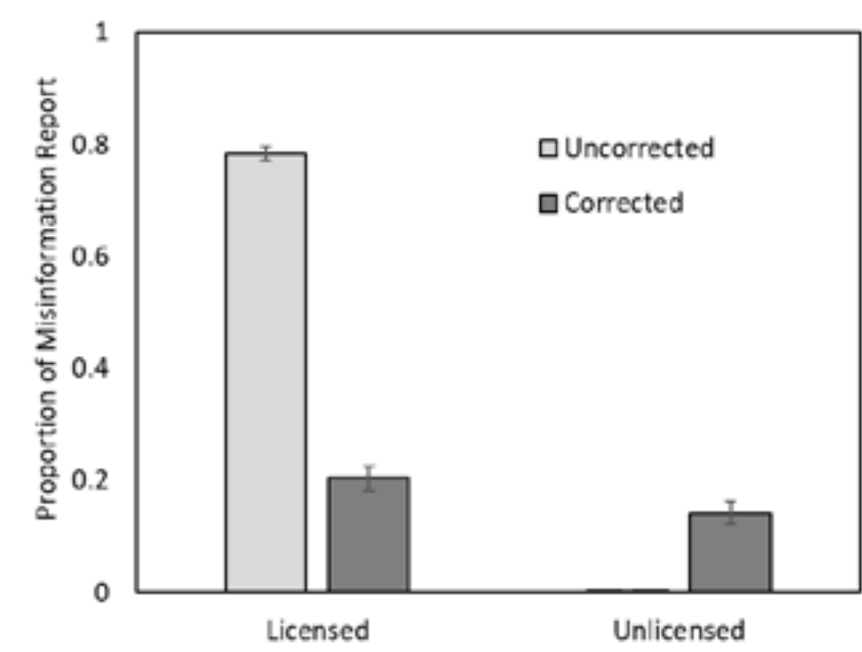


Figure 2. Proportion of misinformation report in each experimental condition. The visible error bars represent ± 1 standard error.

Discussion

Analysis of our data indicated that the *continued influence effect* did occur within our experiment. Less misinformation belief was reported in the licensed corrected condition than in

the licensed uncorrected condition, but more misinformation belief was reported in the licensed corrected condition than in the unlicensed uncorrected condition. That is, corrections to licensed misinformation decreased belief in that misinformation but did not completely eliminate misinformation belief to pre-exposure levels. This finding is consistent with previous literature on the continued influence effect (Carretta & Moreland, 1983; Ecker et al., 2010; Ecker et al., 2011a; Ecker et al., 2011b; Gordon et al., 2017; Gordon et al., 2019; Guillory & Geraci, 2016; Johnson & Seifert, 1994; Rich & Zaragoza, 2016; Rich et al., 2022; Ross et al., 1975; Wilkes & Leatherbarrow, 1988; Wyer & Budesheim, 1987). Further, this result supports our hypothesis that the continued influence effect would occur as a result of correction to licensed misinformation and adds to the growing literature on the conditions under which the continued influence effect occurs.

In our investigation of backfire effects, we hoped to cause an increase in misinformation use as a result of correcting misinformation and thus find evidence of a backfire effect triggered by unlicensed corrections. Our results indicated that unlicensed corrections did cause an increase in misinformation use above the no-information baseline (unlicensed/uncorrected condition). This finding supports our hypothesis that a backfire effect would occur as a result of unlicensed correction and is consistent with the findings of Autry and Levine (2012, 2014) and Flores and Autry (2021a, 2021b).

It is important to distinguish this effect from other types of backfire effects previously observed. Firstly, there is no evidence to suggest that our finding resembles a *worldview backfire effect*. Notwithstanding the abundance of evidence against the existence of the *worldview backfire effect* (Ecker & Ang 2018; Ecker et al. 2014; Ecker et al. 2021; Guess & Coppock, 2018; Haglin 2017; Wood & Porter, 2019; for a review, see Swire-Thompson et al., 2020), the

items we used involved the meaning of novel words specifically created for this study. Since it is highly unlikely that the participants had any beliefs about the meaning of the words prior to their participation in this study, it is highly unlikely for their worldview to have triggered a backfire effect. Secondly, Prike et al.’s (2023) claim that skepticism of source credibility may have caused the backfire effect seen in their study does not seem to apply to our case. Short of a randomly assigned first name and the order with which information was presented, no context was provided for participants to base any judgment of source credibility on. Although it is possible that participants developed a tendency throughout the study to be more skeptical of speaker one’s knowledge than speaker two’s or vice versa, there was no feedback given to participants to base this judgment on. Any attempt to speculate about source credibility was not reinforced within the study, and consequently, any skepticism bias that could have developed throughout the study was likely a small and random effect. As items were counterbalanced across participants, it is unlikely that this effect significantly influenced our results. Therefore, there is little reason to suspect that skepticism specifically played a role in the occurrence of the backfire effect observed in this study.

It may be the case that the backfire effect observed in this study is due solely to the familiarity increase resulting from an increase in the number of exposures to misinformation from zero to one. This is necessarily the strongest single increase in familiarity possible for a piece of information – as subsequent exposures only increase familiarity by a decreasing ratio (i.e., increasing from two to three exposures yields a 50% increase in exposure whereas three to four yields only a 33% increase and so on). Thus, unlicensed corrections cause the maximum relative increase in misinformation exposure and consequently the maximum relative increase in familiarity with the misinformation being corrected. The strength of this manipulation may

individually account for the resulting backfire effect observed in this study. If this is the case, our results are consistent with the findings of Autry and Duarte (2021) and provide evidence in support of the existence of the *familiarity backfire effect*.

However, while the familiarity effect itself could certainly have contributed to our finding of a backfire effect in this experiment, the evidence against this mechanism’s contribution to backfire effects is substantial (Ecker et al., 2017; Ecker et al., 2020a, 2020b; Ecker et al., 2023; Kemp et al., 2022a; Prike et al., 2023; Swire et al. 2017; Swire-Thompson et al., 2022; Wahlheim et al., 2020) and calls for a more in-depth analysis of other potential causes. While we did increase the number of exposures to misinformation from zero to one exposures, it is important to consider that this increase in familiarity may be categorically different from the typical increases in familiarity that occur between one and many exposures. The cognitive processes which underlie the initial understanding and storage of information are different than the cognitive processes which underlie the recollection and subsequent strengthening of memories (see Pansky et al., 2005). Likely, the latter processes account for the findings that the familiarity effect actually increases the effectiveness of corrections (Ecker et al., 2017; Kemp et al., 2022a; Wahlheim et al., 2020); whereas, the former processes most likely govern the cognition following unlicensed corrections. Specifying this categorical difference narrows our investigation of potential mechanisms for the occurrence of a backfire effect after unlicensed corrections in this study to the processes underlying the initial understanding of corrections to misinformation. One such mechanism proposed by Autry and Levine (2012) is the violation of Gricean maxims inherent in unlicensed statements.

As Prike et al. (2023) were concerned about the potential confound of a violation of Gricean maxims influencing misinformation processing in their investigation of the *familiarity*

backfire effect, they conducted a pilot study prior to their experiments to minimize the perceived oddness and stereotypicality of the standalone (i.e., unlicensed) corrections used in their experiments. Out of eight potential scenarios, only the four least odd and least stereotypical were included in their experiment 1. Thus, Prike et al. minimized the influence of a violation of Gricean maxims on the processing of corrections by their participants. It’s possible that in minimizing the influence of a violation of Gricean maxims, the backfire effect seen as a result of those violations was also minimized. This methodological difference may explain the discrepant findings between Prike et al. and studies which have found evidence of a backfire effect resulting from unlicensed negated correction (Autry & Duarte, 2021; Autry & Levine, 2012, 2014; Flores & Autry, 2021a, 2021b). Furthermore, the fact that Prike et al. did not observe a backfire effect after *minimizing* the influence of a violation of Gricean maxims where we did observe a backfire effect after *maximizing* the influence of the same violations points to the Gricean maxims as playing a causal role in the occurrence of a backfire effect in the condition of unlicensed negated correction.

People’s tendency, in cooperative communication, to assume that information is truthful, informative, relevant, and stated clearly is typically helpful in facilitating fluent communication. However, when these Gricean maxims are violated, unintended assumptions are made by their recipients (Autry & Levine, 2012). In the case of unlicensed negated correction of misinformation, the inherent violation of the Gricean maxim of relation causes recipients to question why the information is being conveyed. Before assuming that the information is simply irrelevant (i.e., that the speaker is violating the higher-order cooperative principle), readers assume that the maxim of relation is being “flouted.” This triggers a generation of inferences attempting to explain why the information could have been conveyed. These inferences will

ultimately include the ideas that there must be sufficient reason to believe the misinformation, as there is evidently sufficient justification to provide a correction, and that there are unmentioned reasons to be skeptical of the correction (Prike et al., 2023), as the speaker’s motivation for correcting the misinformation is yet unsubstantiated. These ideas may then inadvertently cause readers’ reliance on the corrected misinformation to increase, thus triggering a backfire effect.

Limitations and Future Research

Although it is unlikely that skepticism played a role in the processing of the unlicensed corrections present in this study, we did not measure participants’ perception of source credibility and thus cannot form any conclusions about this potential confound. As Prike et al. (2023) did observe a backfire effect in their high-skepticism condition, future research should investigate the influence of readers’ perception of source credibility on the possible occurrence of backfire effects. The effect of skepticism on the occurrence of backfire effects should also be distinguished from backfire effects caused by the familiarity effect or a violation of Gricean maxims in future investigations.

Because our sample was entirely constructed with self-selected college students, the external validity of our findings is limited. This sampling method is inherently non-random and the possibility of demographic-specific effects cannot be ruled out. Future research should use a more representative sampling method to ensure that these findings are consistent across cognitively relevant demographic characteristics.

It will be necessary in future research to distinguish whether the backfire effect observed in this study is due to the increase in familiarity of misinformation concepts or to the additional presupposition processing (Autry & Levine, 2012, 2014) triggered by a violation of the Gricean maxims of communication (Grice, 1975). As our results may imply the existence of a novel

mechanism underlying the occurrence of backfire effects, future research should seek to replicate this finding while specifically manipulating the strength of the violations of Gricean maxims present in unlicensed negated corrections. In addition to the tendency for violations of the Gricean maxim of relation to cause backfire effects, violations to the Gricean maxims in general (i.e., the maxims of quantity, quality, and manner as well) should be further explored in future research to investigate whether they might also trigger a backfire effect.

Future research should also investigate the degree to which this type of backfire effect is harmful to the effective correction of misinformation. After unlicensed corrections, how many individuals hold a positive belief against the misinformation presented versus hold a tentative belief for the same misinformation? That is, in spite of the occurrence of a backfire effect, do unlicensed corrections still correct more people than they spread misinformation to?

Conclusion

This study has outlined an area of misinformation research that has, as yet, not been fully explored. Our results suggest that a backfire effect may be triggered when the Gricean maxims of communication are violated, as in the case of unlicensed negated corrections. This mechanism is distinct from both the *worldview backfire effect* and the *familiarity backfire effect*. Due to the nature and limitations of our study, it is necessary for this finding to be replicated in future research with a more representative sample. However, this study illustrates the potential dangers of correcting misinformation in a way that violates the Gricean maxims. This may be especially harmful when using unlicensed negated corrections in the title of retraction articles. If a correction is not licensed (thereby violating the Gricean maxim of relation), it may inadvertently increase readers’ reliance on the misinformation being corrected. It will be especially important to avoid violating the Gricean maxims of communication in brief corrections to misinformation (i.e., in titles, short-form fact-checks, and brief media statements) if this effect is replicated in future investigations that specifically manipulate the strength of the violations of Gricean maxims in unlicensed corrections to misinformation.

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Resident Perceptions of Neighborhood Change in Los Angeles: Boyle Heights

Introduction

Researchers in the social sciences have long been interested in the changing processes within communities of minority and immigrant neighborhoods. Non-white newcomers have historically been treated disproportionately unfair and with lack of consideration. This is a direct, contrast to their affluent majority counterparts, who are typically wealthier, higher educated, and can more easily access resources. In more ways than one, communities that house minorities and immigrants face disparate challenges including racial and ethnic prejudices, housing discrimination, limited access to forms of transit, schools, education, and parks which subsequently have been proven to aid in the developmental processes of young children. These individuals and residents burdened and faced with high unaffordable costs, also face unaffordable rent and scarce rental units, homelessness, an increase in demand for social services, run down infrastructure, and polarization. With a general increase in higher prices ranging from high rents to high costs of living, these communities risk facing gentrification due to the unaffordability of rising costs within their communities. This is an exacerbated problem that has affected the investments and attachments of many individuals that have developed strong sentiments and experiences in and of these hometowns, this concept is best known as, place attachment. Gentrification, moreover, involves the changing characteristics of poor urban communities by a new influx of demographically evolved residents who, along the way, improve housing and bring new businesses at the expense of lower income. In fact, long-time residents are often faced with forced displacement from neighborhoods they have grown attached to through emotional, psychological, familial, and communal bonds. Minority and immigrant communities are often targeted by elites, politicians, investors and, most notoriously, the media

who is eager to depict a required need to change urban places into upscale areas and increase revenue, turn a profit, and seek political and ideological agenda by means of profit gains.

The problem lies wholly on finance seeking actors who are less concerned about residents’ attachment to places or neighborhoods, and more concerned about political and/or financial gain.

The city of Boyle Heights is one of these communities, which has had a long rich historical background for housing immigrants, political activism, marches, protests, resistance, and political participation. If not addressed, livelihoods, secured sense of place, and neighborhood attachments for residents of Boyle Heights and other small immigrant-minority communities will become threatened. Confidence in communities may begin to see shifts if opposition against gentrifiers, or those who willing to change the community is not taken. Other neighboring cities that border the surrounding area of already gentrified communities also prove to be at stake and risk for gentrification as previous literature has shown. The topic and process of place attachment has been explored for years but not much research has been conducted on smaller communities within large cities such as Boyle Heights of LA. Specifically this paper intends to analyze the media contribution and influence of commodifying and capitalizing ethnic enclaves, specifically those with deep cultural and historical roots like the city of Boyle Heights. The media primarily has had a long history of influencing the public’s perceptions on “run-down-urban-areas”.

Influential tactics by the media are expressed through avenues such as newspapers, television news broadcasters, and social media platforms to which provide skillful and strategic use of words and word framing to depict a certain message to relay onto the public, investors, and politicians. Often messages and word framing utilized have implications for inhabitants within these communities, thus, this paper intends to understand how residents distinguish and undergo

change within their neighborhoods while also accounting for variable influences such as the media on immigrant communities within Los Angeles. Likewise, this paper explores how residents are responding to neighborhood change, specifically taking a deeper dive into the case of Boyle Heights. This paper will first evaluate the context behind the city of Los Angeles and Boyle Heights. Instances of media influences, gentrification, and displacement within the two cities will be further revealed, followed up with a brief literature review analyzing the media’s role and concepts of place and neighborhood attachment. Furthermore, the methodology of the study is discussed with a follow up of the findings and analysis from interviews recruited and conducted based on residents’ perceptions to neighborhood change. Lastly, this paper will offer some policy recommendations for any future studies.

The History of Media influences, Gentrification, and Displacement in Los Angeles and Boyle Heights



Figure 1. Map of Los Angeles (Fulton, 1997).

History of Los Angeles

The image provided in figure 1 offers a glimpse into a large span of the territory that encompasses the Los Angeles Metropolitan area, which stretches from Ventura County across Riverside, and down to San Diego County (Fulton, 1997, p.3). The cities roots begin in 1781 in what was first named, “The Town of Our Lady the Queen of the Angels of Porciúncula,” (lacity.gov, 2023) and like many other instances of colonialism, Los Angeles was found of colonized settlers traced back from Spanish, European, Indian, and African descendance (Sonenshein, 2006, p. 26). However, this is the first instance of gentrification within the city. In the early history of Los Angeles, inhabitants consisted mainly of Hispanics and farmers in large open sprawled areas of land. Yet, the media’s role in gentrification occurs here. Trends began with a migration of white Midwesterners beginning from the 1800s up until the 1920s. The media’s welcoming attempts of boosterism and promoting or selling the image of the city began by the use of alluring ads and tactical word framing (p. 27). Tactics like these sought to increase the growth and development of the city while simultaneously creating a more lustrous brand to

LA. One example presented by White (2020) in figure 2 shows the Los Angeles Chamber of Commerce funded *The Land of Sunshine* to boost Southern California” (p. 41).



Figure 2. *The Land of Sunshine* boosterism Ad by the LA Chamber of Commerce (White, 2020).

Furthermore, the *Los Angeles Times*, also fueled new demographic and socioeconomic shifts to LA. By selling and boosting the public’s perception of promoting the idea of “glorious weather and seemingly limitless economic opportunities, advertised as a place to seek the “good life” (p. 27). However, the city was not full of natural opportunities, it included reoccurring droughts, wildfires, limited rainfall, mudslides, and earthquakes (Fulton, p. 6). Migrants flocked to what they considered a new land of opportunity of wide-open fields, easy farmlands, and rural cities in order to escape the hustle and bustle of the large urban populations of the east coast while

simultaneously occupying areas that housed minorities, ultimately introducing the beginning phases of gentrification.

History of Boyle Heights

Boyle Heights is a community of predominately low-income Hispanic residents that encompasses 15 square miles of East Los Angeles with a population of 188,741. Sixty percent of the population is minority Hispanic with a median income of \$49,212 as of 2021, while 26.7% of the persons living within this community live below the poverty line. Levels of education are reflected with statistics showing that 69% of the residents have a high school education or some college, while only 30% has a bachelor’s degree or more. The predominant language spoken in households totals to 68.8% Spanish speaking, while 39.3% of residents are foreign born. Due to the high percentage of 87% renter occupied units within this community, figure 3 supportively displays the high likelihood of extreme displacement of residents. The map below (figure 3) is provided by the Urban Displacement Project which shows the Estimated Displacement Risk (EDR) model. This model specifies which areas of low income are at risk for displacement. The city of Boyle Heights is shaded red, suggesting Boyle Heights lies in an area in the level two income group category, which is at risk for extreme displacement (Thomas et, al., 2022). Neighboring surrounding areas also show ‘probable displacement,’ which suggests concern for imminent change.

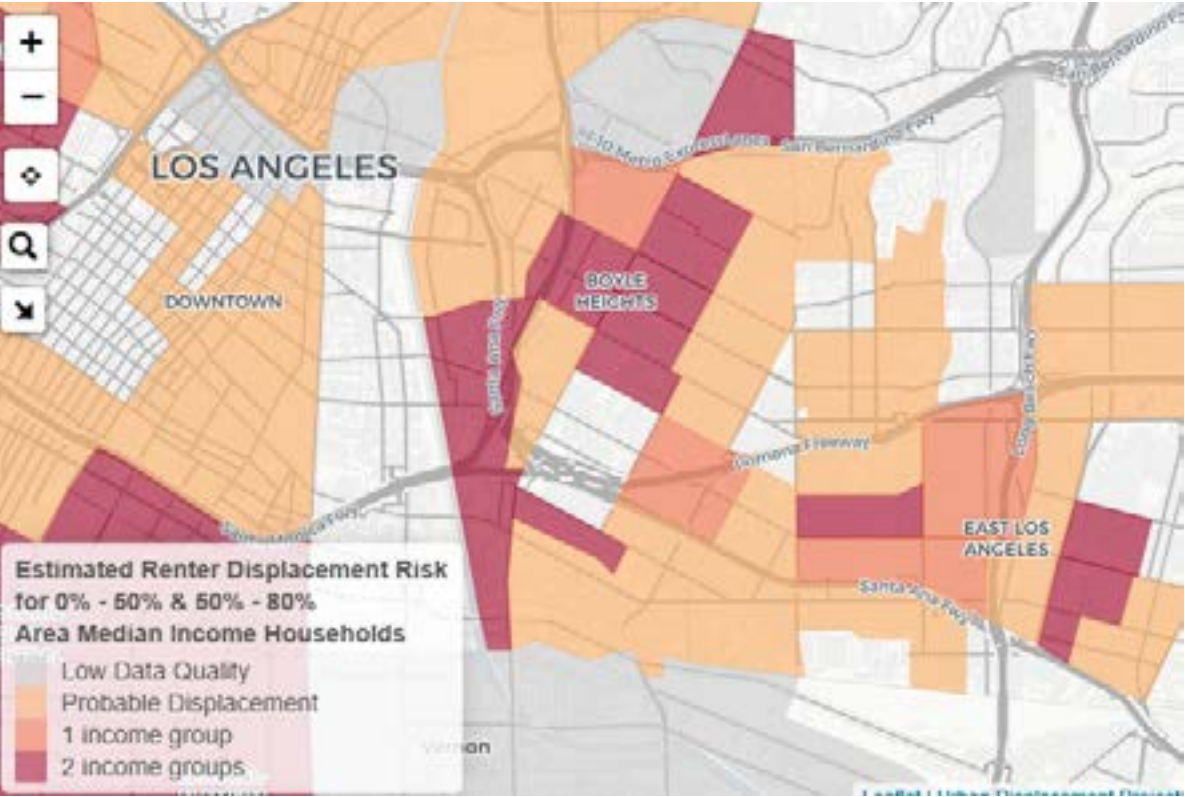


Figure 3. Displacement Risk model for Boyle Heights

Although Boyle Heights is currently a predominantly Latino community, it was not always this way. The city originally started as a multi-racial and multi-ethnic enclave consisting of Russian, Jewish, Japanese, Armenian, Italian, and Chinese descent. The first instance of displacement within Boyle Heights occurred during the 1940’s. Much of the population that inhabited it consisted of Japanese Americans however, during post World War 2 the United States military incarcerated approximately 10,000 Japanese Americans in California and were forced to reside in the barracks at Manzanar in Inyo County (Hile, K., 2017, p. 68). After the war ended, many Japanese from Boyle Heights were left displaced and the demographics within this community began to change. In the early 1950’s another instance of gentrification and displacement occurred as the city began construction for the new interstate highway that would cross 135 acres in East Los Angeles and ultimately affect residents. Though 15,000 were displaced, the city of Los

Angeles promised low-rent housing to whomever was affected by the construction of the new interstate highway. Many residents waited but fulfillment of these promises by the city were never made. In fact, in 1953, the city decided to oppose the housing project that was promised to displaced residents and eventually dedicated that land for “public purposes only” (Estrada, 2005, p. 288). Present day Boyle Heights is still at risk of gentrification as the map previously shows. There has been an influx of art galleries, art districts, restaurants, and construction of modern housing that threatens long-time residents’ chances of continual affordable living within these communities. A more recent example of this occurred in June 2017 when *Weird Wave Coffee* opened their doors within Boyle Heights. The shop was met with resistance from residents and anti-gentrification groups like *Defend Boyle Heights* who created flyers and participated in protests in front of the location in hopes to trouble the new business into leaving.

Boyle Heights as a community has had a historical background in political activism, marches and protests dating back to the 1940’s during the Zoot-Suit Riots. Hispanic men, some African Americans and Asians were harassed and stripped of their suits by a slurry of white enlisted Marines and Navy men. However, the law defended the service men and enacted a law that made it illegal to wear zoot suits. The Los Angeles Times even went so far as to title an article in the paper, “Zoot Suiters Learn Lesson in Fights with service men.” This is yet another instance in which the media has contributed to harmful word framing. Furthermore, the 1960’s Chicano Movement driven by the Civil Rights Movement inspired many students from Wilson High School to protest and march for Hispanic equality (Garcia, 2022). In 1986 Mothers of East LA (MELA) was formed in efforts to strongly oppose the construction of a new prison in East LA, the organization now focuses on support in the schooling system and environmental impacts. The

dynamic of political activism that has been prominent within the city of Boyle Heights has evolved due to the incorporation of neighborhood councils. In this way, Boyle Heights is one of the strongest and most prominent culturally rich areas in Los Angeles.

Brief Literature Review

The Media’s role

Within the discourse surrounding the media’s role on gentrification, much of what is available suggests that newspapers promote the idea of gentrification, through use of subtle terms and specific words that disassociates the average reader from the actual political aim of the topic. Careful words with positive or lamenting connotations are expressed to distract readers of the detrimental implications of what could occur to residents of gentrified or potentially gentrified areas. Wilson & Mueller (2004) explains this process and provides the term ‘growth coalitions’ as one example of the media’s tactical use of word framing (p. 282) to express the promotion of city growth by luring elites, politicians, and businesspersons to invest. Other examples involve using direct antonyms for what insiders or native residents would describe their own neighborhoods. Examples include needing “nourishment [or] resuscitation” and treating the “poor, run-down” cities as if they were “living organisms” by using phrases like “a dying heart [of a city]” or “limping”, needing “resuscitation” to evoke sympathy and the idea that only investors willing to drop their money on “revitalizing” a city can save a neighborhood or community from “dying”. Albeit the history of the media influencing readers has occurred for years it has done so evolutionarily as terms like “yuppie” or “hipster” were often used to label an individual as a gentrifier (Brown-Scaracino & Rumpf, 2011, p. 295). Nowadays terms like “house-flippers” and “home improvers” can be seen used on television shows for gentrifiers

who are changing homes set in areas known to house lower income, minority, and ethnic neighborhoods. Zukin & Braslow (2011) refers to this changing class as the “creative class” (p. 131) that builds “creative cities” in cultural areas. These investors are credited with driving in revenue and modernizing areas with the times when really the ethnic enclaves and long-time inhabitants are who bring the historical and cultural element to these cities and neighborhoods. Hipsters willing to drive revenue bring the cities up to date and “shape and consume new art, food, media content, and fashion: the dominant symbols of modern times” (p. 132).

Neighborhood Branding

Most research on neighborhood branding associates the process of commodification with the latter and signifies that once commodification has begun, gentrification is already underway or has been completed. In order for a neighborhood’s brand to become a prime and central destination for tourists, the process must first begin with governments and towns, commodifying the enclave with aims of increasing revenue. Terzano (2014) describes the process of commodification of an area that was once filled with inhabitants of a particular ethnic group now beginning to dwindle, however the reputation of the area which was once prominently filled with that particular ethnic group is now boosted for tourism purposes. Telling signs that a community has been commodified includes advertising, billboards, signs, logos, banners, or posters, with the enclave’s name on it, attempting to lure tourists to visit the conserved area. Often times these advertisements may be seen on newspaper ads or social media platforms during times of traditional festivals. Boyle (1997) describes this boosting and commodification process by governments and the media as “Urban Propaganda Projects” or UPPs, which are attempts to capitalize on hallmark festivals. Often times residents of ethnic enclaves and other tourists are

unaware that this process is happening because of the Marxist underpinnings, stated by Boyle (1997).

One example of this may be Día de Los Muertos, or Day of the Dead, a traditional festival of Mexican origins which celebrates the deceased by displaying alters and offerings to those that have passed on to the afterlife. Festivals for Day of the Dead nowadays are celebrated with music and alcohol but it was not always this way before. The festival was originally an event celebrated in cemeteries bringing families together and commemorating deceased family and friends through celebration of their presence, however, recent festivities of this cultural event now include vendors and alcohol sales. Boyle (1997) explains that alcoholic consumption distracts locals from the true goal of governments and the media. By associating emotional and psychological bonds of a festival to a place, tourists and social media influencers disconnect and disassociate native inhabitants from their enclaves, Vuignier (2016) recognizes this process as a marketing tool for managers to capitalize on. Beauregard (1990) cites Harvey (1985) and Mollenkopf (1981) which explain, clashes are made between neighborhoods and investors when neighborhoods seeks to form communities but investors aim for wealth and profits (p.856). With the help of cultural identities and historical legacies (Bonakdar & Audirac, 2019) these marketing tools make branding easier to develop on those who are natives to the city or place. Boyle Heights is one of these areas.

Place Attachment & Neighborhood Attachment

Research on place attachment and neighborhood attachment are two related concepts that have been researched for years and play an integral role in understanding residents’ perception of

changes within their communities. Place attachment is defined as “the bonding that occurs between individuals and their meaningful and important places” (Scannell & Gifford, 2009, p. 1). This concept is known to explain a human need that aids in defining an individual, Scannell & Gifford (2009) explains that by connecting to a place, an individual can identify themselves and ancestral ties, which creates a sense of place, belonging, and feelings of in-group emotions. This sub-concept of place attachment is expressed as place identity. Furthermore, the significance of this concept leads to inauspicious consequences. An emphasis therefore should be on individuals who search for a place that is no longer there, like a child torn away from their “attached place” during times of war. Place attachment is relative because people are forced to relocate. Likewise, individuals attach themselves to places, albeit, on marginally lesser grounds such as neighborhoods. More along, Grief (2009) explains that neighborhood attachment serves many functions, it boosts well-being, life satisfaction, and promotes longer inhabitation of an area while allowing greater insight into the community, the residents, resources, social networks, and quality of life (p. 40). To further understand the effects of neighborhood attachment, Gorny & Torunczyk-Ruiz (2014) add that the concept also promotes social cohesion, trust, tolerance, shared norms, and social bonds however increasing ethnic diversities decreases social and neighborhood cohesion. The authors explain that this is due to increased competition for resources. The changes of a community have some effect on how a resident perceives neighborhood change as they see shifts from what was once a place they created memories and life events to changes of mistrust within the community and government.

Methodology

This study utilized qualitative methods and semi-structured interviews. The research revolved around Boyle Heights and sought to understand residents’ view on neighborhood change. From January to May 2023 this research recruited two interviews from various perspectives. In order to recruit interviewees, participants were contacted via email correspondence, and recruited through L.A. City Hall meetings. The first participant provided a community organizer, Neighborhood Council, and third generational perspective while the second participant provided a stakeholder perspective. Interviews were conducted dependent on the availability and preference of the interviewees which both occurred via Zoom, roughly lasting 60 minutes and involved a series of open-ended questions which sought to understand the unique lived experiences, perceptions, and observations of each individual. To protect the identities of the respondents, pseudonyms were used throughout the paper and are labeled as ‘participant A’ and ‘participant B’.

In terms of weaknesses, this study was characterized containing multiple limitations, time allocated toward recruiting participants was limited and the sampling size was much smaller than expected. Because of the small number of participants, this study does not consist of a collective representative view of stakeholders, residents, and neighborhood council members but does offer a random sampling perspective.

Findings

Neighborhood Councils and a Force for Change

This paper finds a strong relationship between residents and neighborhood councils. Neighborhood councils were enacted in the Los Angeles charter in 2000 and allows for members of the public to engage in participatory democracy. Councils allow residents to express their

concerns to the City of Los Angeles and work in conjunction with other organizations, neighborhoods, and stakeholders. Members of neighborhood councils, which are typically filled by residents and stakeholders, are allotted advisory roles and powers which permit them to influence decision making within their own communities. In contrast, extra powers to council members are argued necessary for members to become more effective and integrated in the decision-making process beyond just advisory roles (Soneshein, p. 169). According to the Boyle Heights Neighborhood Council, it has successfully served 85,000 residents (about the seating capacity of the Los Angeles Memorial Coliseum) as of 2002 with an increasing number yearly. The Bylaws of the neighborhood council state they seek to develop pride of the community, find solutions, educate stakeholders, and inform city government of any recommendations or priorities within the community (Boyle Heights Bylaws, 2020).

To prove the strength of the correlational relationship between residents and neighborhood councils, one instance during April of 2023 demonstrated during, a Planning and Land Use Management Commission hearing at LA City Hall regarding the Boyle Heights Community Plan update that emphasized the pertinence of constituents, member roles, and the effectiveness of these systems. At the time of this paper, one member of the Boyle Heights Neighborhood Council (BHNC), explained “the community was left out in terms of input. This is another form of political corruption that has been going on for decades” (personal communication, April 18, 2023). Many residents, stakeholders, non-profit organizations, and members of BHNC attended and provided testimony, many against and for moving forward with the Community Plan update, arguing that much of the data provided by the City Planning department was outdated and did not align with resident’s concerns about Boyle Heights, while others argued they have waited

long enough. In short, according to Los Angeles City Planning (2023), the community plan would “build on Boyle Heights’ diverse historic character and history and will apply new zoning tools developed as part of the City’s recode LA project.” The Boyle Heights Neighborhood Council stands as a form of community engagement to resist gentrification and displacement while further promoting the livelihood and sustainability of the city. It serves as a vital functioning role to protect the residents from investors seeking to change the characteristics and demographics of the city. The idea of place attachment and place identity additionally demonstrate a strong relationship that is exhibited by the residents of Boyle Heights, which has one of the strongest neighborhood councils in the state. To protect livelihoods, maintain secured sense of place, and fend neighborhood attachments against the threats and assail of gentrifiers and government entities, residents utilize neighborhood councils to their advantage in order to maintain confidence within their communities.

Through the conceptual notion of ‘a space in-between,’ according to Collins & Loukaitou-Sideris (2016), this notion is best understood as an emergence for new opportunities of growth, “new political engagement, a blending of different strategies of revitalization and possibilities of forming partnerships for [the aim of] social preservation” (p. 413). Neighborhood Councils provide as an example, and a formation of this process as it works. This paper finds influential factors and forces situations to create opportunities to arise, as was the case for the interviewed Neighborhood Council member who was placed in ‘a space in-between’ when participant A found themselves at the cusp of the dialogue, between the MTA (the Metropolitan Transportation Authority and the Community Redevelopment Agency. These two governmental organizations

had intentions of relocating residents which fueled the dynamic of a new form of political engagement, albeit with circumstances leading to relocating inhabitants.

“ I’ll give you my little version on how they kind of contacted me. The MTA (the Metropolitan Transportation Authority) and the Community Redevelopment Agency wanted to come into the community and relocate people to build a transportations system, the MTA red line, which is now the gold line. My grandfather’s house was on the verge of eminent domain [when] my mom and dad received a letter in the mail... they said, ‘your Grandfather’s house is on the line and we don’t understand why they’re mailing it here’...so I went to a meeting at White Memorial Hospital [where] they had aerial photographs on the wall. The MTA representative said, ‘Welcome, thank you for coming. We want you to each get in line and look at the aerial photograph and if you see your home here, stay, if you don’t you can leave.’” that’s when the fire in my belly just exploded. [The MTA was to] ‘to build a rail, and some of the properties are impacted’[Another member in the audience said] “over my dead body, you’re trying to kick all the Mexicans out.” That’s exactly what they were doing, without any relocation funding or rights or anything. These two entities took advantage of the fact that many of the people who live here are limited in terms of education, and would never question”

Though the widely accepted notion holds that gentrification is a ‘zero-sum game’ such as defined by winners (gentrifiers) and losers (residents), there still arises an opportunity for positive growth in the form of forced situations which creates new opportunities for residents to champion their voices and engage in participatory democracy. Though the complexity of the dialogue is deep rooted, participant A felt,

“This is what they do. [Governments, agencies, and developers] prey on people that are limited in education and will not question the authorities or the system. So they call it progress...progress to me is, if you want to do something in the community, you have to make sure that people who are impacted are at the table.”

Neighborhood Councils, stakeholders, and residents serve a vital role in the functioning, preservation, and shaping of their communities to affect change.

The Media’s Effects

Though there is a debate regarding the application of marketing tools to sell a place’s ‘history, culture, and identity,” Vuignier (2016) finds that this process proves elite’s exploitative tendencies which is affirmed through media tactics. Films, television news broadcastings, and social media, at times, use symbols of poverty to portray communities and places, such as in films like, *American Me* (1992), *Blood In, Blood Out* (1993), and *My Family* (1995) which are centered in Los Angeles, predominantly East Los Angeles. Cities thus become commodified, Terzano (2014) finds this commodification process on ethnic enclaves produces great profits (p.345). When the media creates films, broadcastings, or news reporting’s on ethnic enclaves they do so as if these places portray the need for help. Resident’s own perceptions to these enclaves, however, are not described as the media depicts them and thus create an illusion to the outside world that these places should be “revitalized” because of the dangers associated with them. When this happens, investors become inclined to step in and thus change the financial capacity of the ethnic majorities who live within these communities. Participant B said, “Boyle Heights, to some regard...has been commodified by the media, whether it's from low riders to

chola culture. Boyle Heights has gone through a lot of sweeping changes or trends in the way it’s represented [in] the media.”

When asked both participant A and B of how their neighborhoods are represented in the media through films, they used similar words such as: poor, low-income, fear, danger, gangs, Latino. Furthermore, when asked how others, *not* from their neighborhood perceive Boyle Heights, both respondents said others view their neighborhood as a “ghetto”. This study suggests careful narrative of the depiction of these cities.

Participant B was quoted saying,

“I’m going to tell you the first thing that comes to my head because my kids have said it: the ghetto and a sense of fear”

Analyzing that...

“it’s basically their evaluation of a lack of social investment and government lack of investment. If you were to go to Boyle Heights, it’s basically surrounded by industrial area. It’s sector off into this environmentally unfriendly area. I think that’s what folks think because that’s what they see as they pass by, but on that, it’s a superficial evaluation alone. You don’t get the experience of the culture, the art, everything else that comes with it”

On the other hand, when asked how they view their neighborhoods, words describing the antithesis of outsider’s perspective views, were words with more positive connotations and associations. Participant B described,

“I think of my childhood. History. I think of home...I always feel at peace when I’m in my neighborhood.”

Participant A explained,

“I think of history...culture...family, unity. I think of compassion, love, diversity...I hope in the future Boyle Heights will be described as something positive...but some of the historical voice will be lost [when referring to effects of the media and gentrification.]”

When asked respondents about the way they felt about how their neighborhoods were represented in the media Participant B noted,

“I feel like there’s a lot of culture, a lot of activism and the media picks up on that... whether is art [or] mural work of Boyle Heights... it’s always been a hub for social change...for culture...and I think with every generation the character of the voice changes and it’s another story being told.”



Figure 4. Mural artwork dedicated in solidarity to workers, documented and undocumented. (Urenda et. Al., n.d.).

This study found that these representations impact residents, as previously cited by Collins & Loukaitou-Sideris (2016) and proves this ‘space in-between’ occurs in the aim of social preservation. This paper suggests that this may take form through commodification schemes and at times emphasizes the murals and artworks of these communities to capitalize, doing so in art districts, often found as a hub for culture and activism, a staple piece for immigrant communities demonstrated in the news and social media. In turn, this social preservation process is mobilized through murals which has a direct effect on residents. Partipants B stated,

“[media representations] impact me because I am where I come from... and in many ways murals are a huge part of my childhood. I remember seeing murals all over. There was one on Whittier Boulevard next to the one stop immigration community center and on the side of the wall it says, ‘El presente as de lucha, el future es nuestro’, the present is a struggle, but the future is ours. Those phrases still live on in my head.”

Vuignier (2016) cites Zenker & Braun’s (2010) place branding as a group of “associations in the consumers’ mind...through aim’s, communication, values, and the general culture of the place,” explaining that in order to design a branding of a place, this design should be formulated with the aspects of the vision for the brand and a definition of the identity and values of the brand (p.35). It is by definition that a brand must be able to produce a brand effect (Kapferer, 2012) implying that the media does more than just create logos, banners, and slogans. They impact residents as their homes come under spotlight and target for tourism and investment.

Policy Recommendations

Policy Recommendations

Future policies to consider in order to decrease gentrification or displacement amongst residents first includes a Right to Return policy, which would mean that any residents who are displaced or gentrified due to new businesses, art galleries, or the city’s zoning and planning efforts, should have the right to return through a priority list that are followed through and held accountable for any government that does not uphold their end agreements. These individuals who previously were renters or owner occupiers should be granted priority for replacement housing. To add, in order to decrease the likelihood of displacement occurring, a No Net Loss Program should be considered to ensure the reducing possibility of demolished homes or apartments that house lower income individuals while subsequently increasing the construction of rent-stabilizing units and promote Community Land Trusts, which is the last policy recommendation. Community Land Trusts are formed by non-profit organizations to acquire, purchase, hold, or remove land for a community in purposes to dedicate those spaces for protecting historic buildings, land, and develop more affordable housing. Furthermore, although not a policy recommendation, this paper suggests that cities, stakeholders, non-profit organizations, community organizations, and residents beware of any careful or tactical wording that may be used in the media that may be telling signs that their community is on the quest for investors which may be the beginning signs of gentrification. Support, organization, and education for resistance against gentrification is imperative for the continued survival of residents to live within their communities without being displaced.

Conclusion

Top political elites, investors and the media have historically impacted the development of the city of Los Angeles and smaller communities within them at aims of coercing minorities to

further commodify ethnic spaces, although especially in Boyle Heights. Historical events of discrimination, unfair and unjust treatment, displacement, and disregard for communities trace back to the 1800’s and even now in recent times. Neighborhood branding has evolved communities for marketing schemes and disregarded long-time residents’ feelings of place attachment and neighborhood attachment within an area that they have formed intimate life events. Boyle Heights, rich in political activism, marches, protests, and civil disobedience is a strong exemplification of valor, heroism, courage, and tenacity. This paper contributes to the current literature by examining the impact of resident’s perceptions through exploration of the concepts of neighborhood branding, place and neighborhood attachment, and the media’s role. The findings based on Los Angeles are generalizable and allows insight into other larger metropolitan areas such as New York to begin the discussion on smaller areas, neighborhoods, and communities within these much larger cities however, more research is demanded to understand the impacts on smaller communities within the multiethnic metropolis city of Los Angeles, calling for a deeper dive and evaluation into particular ethnic enclaves, that of which Los Angeles is known for.

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Tovar
Gloria*

AI-Enhanced Flying Telescope for Artemis: Pioneering Space Exploration via Computer Vision

Abstract—This project aims to augment the ARTEMIS missions through a cutting-edge Unmanned Aerial Vehicle (UAV) equipped with sophisticated computer vision for astronomical observation. Employing the You Only Look Once (YOLO) algorithm, OpenCV, and several stellar databases, this UAV is designed to provide real-time analysis and live transmission of celestial phenomena, supporting sustainable lunar exploration and advancing our understanding of the cosmos. Despite budgetary constraints necessitating an initial propeller-based design, the project aspires to integrate turbine engines in the future to enhance space mission compatibility. This initiative represents a significant stride towards leveraging advanced technology to expand space exploration and knowledge, embodying the pioneering spirit of the ARTEMIS mission.

Index Terms—UAV, OpenCV, SkyField, YOLO, Advanced Computer Vision, Hardware Engineering

I. INTRODUCTION

In their pursuit of transcending Earth’s atmospheric limitations for astronomical observation, the Kepler-22b team, comprising adept engineering students, introduces a novel approach to overcome challenges inherent to ground-based telescopes. Traditional telescopic methods, vital for our exploration of the cosmos, face significant obstacles due to atmospheric distortions, light pollution, and the immobility of terrestrial observatories. These hurdles compromise the clarity and precision necessary to unravel the mysteries of the celestial sphere [1].

To address these challenges, the team undertakes the development of a high-capacity drone equipped with an advanced onboard telescope system, designed to ascend beyond earthly barriers. This project not only supports the ambitious objectives of NASA’s Artemis mission [2] but also seeks to revolutionize celestial observation. Through the integration of cutting-edge manufacturing techniques and sophisticated software, this UAV promises dynamic, unobstructed views of the universe, heralding a new era in astronomical research [3].

The construction of the UAV leverages the precision of CNC machining and the versatility of 3D printing, utilizing both traditional filament-based [4] and innovative resin-based techniques [5]. Chosen for their accuracy and adaptability, these manufacturing processes are crucial for rapid prototyping and meticulous customization of the drone’s components, ensuring suitability for high-altitude operations and observations.

Central to the UAV’s operational success is the integration of groundbreaking software algorithms. The introduction of StarFinder, a software developed by the Kepler-22b team, harnesses the YOLO algorithm and OpenCV library to recognize and analyze celestial bodies. Informed by data from the ESA HIPPARCOS Mission catalog [6], this software enables the UAV to identify celestial objects in real-time with unprecedented precision, essential for navigating a drone with an 80 Kg total thrust capacity, ensuring stable flight and accurate data collection across diverse atmospheric conditions.

By merging advanced manufacturing techniques with the innovative StarFinder software, the Kepler-22b team’s initiative not only aligns with the objectives of the Artemis mission but also lays the groundwork for future breakthroughs in space exploration and observation. This project represents a significant shift towards employing dynamic, technologically advanced methodologies for cosmic engagement, epitomizing humanity’s enduring quest to explore, comprehend, and establish a deeper connection with the vast universe.

II. PROJECT MANAGEMENT

While the concept of a heavy-lift drone is not novel, the innovation lies in attaching, stabilizing, and controlling the movement of a telescope on such a drone. This task is complicated further when introducing a camera vulnerable to motion blur in low-light conditions, underscoring the critical need for maximum stability. Ideally, the drone is designed to reach altitudes above the clouds, offering an unobstructed view of the sky. Once the hardware is optimized, software enhancements will follow, enriching the system with added functionality and data processing capabilities. Addressing these complex requirements involves a multi-faceted approach. Initially, the team focuses on constructing a drone equipped with robust motors and expansive propellers to meet the demanding payload and altitude requirements. A custom-made carbon fiber frame contributes to structural rigidity and weight minimization while offering protection against minor impacts. Furthermore, the development of a specialized gimbal system is essential for stabilizing the telescope and enabling variable pitch control, facilitating a comprehensive view of the sky. Although commercial gimbals are available, they are tailored

for DSLR or cinema cameras, not telescopes. This customization aims to enhance image quality by minimizing motion blur and ensures control, as direct interaction with the telescope becomes impractical once airborne. Onboard processing capabilities are integral, allowing for real-time software applications that enable ground-based observers to control the telescope and improve image clarity. To efficiently achieve these objectives, the Kepler-22b team is organized into two dedicated sub-teams focusing on hardware and software development, respectively.

The Kepler 22-b hardware team is tasked with the drone's planning, design, and assembly phases. Their responsibilities extend from selecting components to 3D modeling, printing, soldering, and assembling the drone. Specific members are assigned to oversee power distribution, frame construction, and the integration of the gimbal system, ensuring a cohesive build. Additionally, this team oversees the configuration of Raspberry Pi 5 units for data capture and communication.

Conversely, the Kepler 22-b software team concentrates on developing algorithms for computer vision and establishing robust communication links between the drone and ground-based computers. This includes leveraging the YOLO algorithm for object detection and utilizing libraries like Skyfield for celestial tracking. A segment of the team is also dedicated to creating a custom Graphical User Interface (GUI) that facilitates the transmission of commands to the drone and streams live video via Raspberry Pi 5 cameras, supported by the hardware team. Communication is maintained through long-range radios for drone control, with additional data, including the video feed, transmitted over cellular networks.

Despite their distinct areas of focus, the hardware and software teams engage in regular collaboration. Weekly meetings ensure that progress is shared, challenges are addressed, and tasks are strategically reassigned to maintain momentum toward the project's overarching goals. This collaborative environment allows for exchanging ideas, fostering innovation and driving the project forward under a unified vision.

III. INTERIM REPORT

In the interim report, the Kepler-22b team meticulously outlined the initial blueprint and timeline

for the project's evolution, placing particular emphasis on advancing the software components, notably the graphical user interface (GUI) and refining the YOLO algorithm. During this pivotal phase, financial constraints were not a primary consideration, granting the software division the freedom to kickstart GUI development using publicly available images and to seamlessly integrate the YOLO algorithm. Simultaneously, the hardware team embarked on preliminary discussions regarding the conceptualization of a drone capable of transporting a telescope while ensuring stability at soaring altitudes, although no tangible hardware had yet been manufactured or assembled.

A budget justification was meticulously crafted to elucidate the early cost estimates derived from the project's initial requirements. As the project matured throughout the year, the hardware underwent profound design modifications, refining its structural integrity and operational capabilities. Similarly, the software underwent substantial enhancements from its nascent version, driven by iterative improvements and feedback loops, ensuring its alignment with the evolving project objectives and technical requirements. This dynamic evolution underscored the team's commitment to pushing the boundaries of innovation and excellence in both hardware and software domains, laying a robust foundation for the project's continued advancement.

IV. PROJECT OVERSIGHT

While the concept of a heavy-lift drone is not novel, the innovation lies in attaching, stabilizing, and controlling the movement of a telescope on such a drone. This task is complicated further when introducing a camera vulnerable to motion blur in low-light conditions, underscoring the critical need for maximum stability. Ideally, the drone is designed to reach altitudes above the clouds, offering an unobstructed view of the sky. Once the hardware is optimized, software enhancements will follow, enriching the system with added functionality and data processing capabilities. Addressing these complex requirements involves a multi-faceted approach. Initially, the team focuses on constructing a drone equipped with robust motors and expansive propellers to meet the demanding payload and altitude requirements. A custom-made carbon fiber frame contributes to structural rigidity and weight

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innovation and driving the project forward under a unified vision.

V. ENGINEERING APPROACH

A. Systematic Engineering Approach

In the development of the Kepler-22b project, a systematic engineering approach inspired by NASA's core values of Safety, Integrity, Teamwork, Excellence, and Inclusion was embraced. This section explores the comprehensive methodology that steered the project from inception to fruition.

B. Analysis of Requirements

The journey commenced with a meticulous Analysis of Requirements, laying a solid groundwork for the project. Crucial requirements included ensuring the secure attachment of the telescope to the drone, integration of Raspberry Pi 5 for advanced onboard processing, and crafting a user-friendly GUI. This phase was pivotal in defining the project's scope and objectives with clarity.

C. Evaluation through Trade Studies

Following the requirement analysis, the team delved into thorough Trade Studies, diligently assessing various technological options and solutions. These studies were instrumental in evaluating multiple facets of the project, encompassing software frameworks, material selection, propeller efficiency, and the selection of single-board computers (SBCs). Informed decisions from these studies steered the project toward optimal performance and reliability.

D. Iterative Design Refinements

The project underwent iterative Design Refinements, refining each component and system for peak performance. This included iterative development of the GUI for intuitive user interaction, optimization of the drone's design for stability and aerodynamics, and tailoring mounting solutions for seamless integration of hardware components. These iterative refinements were pivotal in evolving the project's design to effectively meet the established requirements.

E. Strategic Decision-Making

The team’s strategic Decision-Making processes were instrumental to the project’s success. Key decisions included selecting the drone frame, opting for Raspberry Pi 5 as the computing platform, and determining the software for object detection and celestial identification. Each decision prioritized performance optimization while aligning with the project’s core values and objectives.

Through this structured systems engineering approach, the Kepler-22b project was meticulously guided from its inception to its successful implementation. Each phase of the process was underpinned by NASA’s core values, underscoring a steadfast commitment to excellence, safety, and collaborative innovation essential for pioneering technological advancements.

VI. ANALYSIS AND RESULTS

Throughout the year, the team has been actively involved in designing two GUIs: one for the drone view and the other for star constellation detection view. Additionally, they have been working extensively with YOLO and have developed Python3 code to implement the SkyField class, aiding in star constellation detection. Here is a summary of the team’s achievements over the past year:

A. YOLO Development

Incorporating open-source algorithms for object detection has significantly advanced the Kepler-22b team telescope drone project. The software team embarked on using YOLO (You Only Look Once) to explore the drone’s object identification and recognition capabilities. Among the iterations of YOLO, YOLOv5 was singled out for its operational efficiency and compatibility with the Raspberry Pi camera as compared with other versions such as YOLOv7 and YOLOv8, marking a strategic choice for the Kepler-22b team project’s technical framework. A trade-off analysis can be found in Appendix ???. The team deliberated on two image capture methodologies: live viewing and SD card storage. Despite aiming for live viewing as the primary method, the team acknowledged SD card storage as a pragmatic interim solution should initial trials with live video feed encounter technical hurdles.

1) *Rationale of YOLOv5 Implementation:* The evolution of drones has spanned various applications, from entertainment spectacles to critical mission executions minimizing human involvement. A notable challenge in deploying drones for object detection tasks is maintaining image quality amidst motion blur caused by rapid movement or high-altitude operations. Opting for YOLOv5, in synergy with SkyField for stellar object detection, was a decision grounded in the algorithm’s precision and accuracy, crucial for identifying star constellations. YOLOv5 distinguishes itself with enhanced feature relevance, streamlining detection accuracy while optimizing computational efficiency by reducing both the operation time and the model’s complexity. This streamlined efficiency positions YOLOv5 as a fitting candidate for aerial image processing, even considering its marginally lower frame rate compared to newer versions like YOLOv7 and YOLOv8. The balanced trade-off between detection speed and precision, along with its adaptability on standard hardware platforms, makes YOLOv5 a compelling choice within the constraints of the Kepler-22b team project’s resources and budget.

2) *Implementing YOLOv5 Framework:* The initialization of YOLOv5 harnessed Python3 for its straightforward syntax and clarity, prioritizing ease of use and understandability. Image preprocessing emerged as a pivotal step in the setup, aimed at standardizing input images to uniform resolutions and formats, thus simplifying model training and inference processes. This preprocessing stage not only ensures model compatibility with input data but also enhances the model’s focus on relevant features by eliminating noise and unnecessary details. Utilizing a database of varied images, including those with blurring and defects, and employing tools like Roboflow and Colab for labeling and preprocessing, showcased YOLOv5’s capability to accurately identify objects under less-than-ideal conditions.

3) *Evaluation of YOLOv5 Performance:* The evaluation of YOLOv5’s effectiveness involved running terminal commands to process selected images, with outcomes directed to an exports folder for review. The discernible difference in object detection accuracy between clear and blurred images, as depicted in Figure 1 (comparison between YOLOv5 and YOLOv8 in blurry image performance) and Figure 2 (YOLOv5 test on partially blurry scene with lots of objects), highlights YOLOv5’s robust per-

formance. This capability significantly bolsters the drone’s object detection potential, proving the software team’s dedication to integrating cutting-edge algorithms for precise and reliable object detection, a critical component in the success and innovative advancement of the telescope drone project.

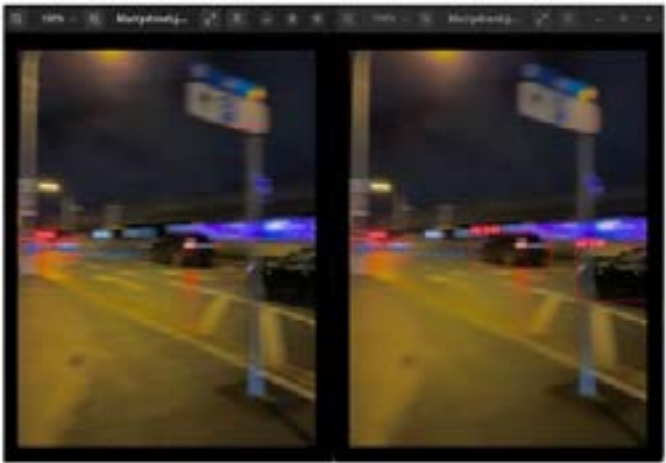


Figure 1: YOLO Blurred Test Comparison between YOLOv5 and YOLOv8



Figure 2: YOLOv5 Detection Test

Through this comprehensive exploration and implementation of YOLOv5, the project underscores the software team’s commitment to employing advanced technological solutions. This dedication not only furthers the project’s objectives but also enriches the field of aerial object detection with valuable insights and methodologies.

B. Enhancing Celestial Tracking

The Kepler-22b team has embarked on an ambitious journey to capture celestial objects using

a telescope and camera mounted on a drone. Pinpointing the exact locations of these objects from an Earth-based observer’s perspective is crucial. This endeavor demands accuracy and real-time data, particularly for tracking stars for long-exposure photography.

Utilizing the Hipparcos Catalogue, the Kepler-22b team aims to ascertain the positions of stars and other celestial bodies with unparalleled precision. This catalogue, a product of the European Space Agency’s Hipparcos mission between 1989 and 1993, offers high-precision data on over 118,000 stars. The mission, an acronym for High Precision Parallax Collecting Satellite, focused on measuring stars’ positions, parallaxes, and proper motions with unprecedented accuracy.

To navigate this extensive dataset, the team developed StarFinder, a Python-based Graphical User Interface (GUI) application. Leveraging the “skyfield” library, known for its accuracy in astronomical computations, StarFinder calculates the positions of celestial bodies with high precision. By inputting a celestial object’s Hipparcos Catalog (HIP) number, StarFinder fetches and calculates the object’s coordinates, revealing its precise sky location. Figure 3 shows how the GUI is able to display the image of the night sky in the window. This figure does not include a feature that was custom developed called “adaptive thresholding”. The general idea is to isolate the bright stars from the dark background. By using a series of equations and data management, the software is able to easily distinguish between the individual stars. Figure 4 shows the same image as Figure 3, but with “adaptive thresholding” turned on. This allows the software to isolate and even label each distinct star in the sky.

This innovative tool, StarFinder, is designed to integrate seamlessly with data from the Hipparcos mission, offering a sophisticated solution for tracking celestial bodies. By inputting an observer’s geographic location along with the target star’s HIP number, StarFinder outputs the celestial coordinates relative to the observer, ensuring accurate tracking.

1) *Mathematical Computation of Celestial Coordinates:* StarFinder’s algorithm computes a star’s celestial coordinates based on its HIP number through a series of precise mathematical operations. This process is vital for accurately locating the star in the sky relative to any point on Earth at any given time. Figure 5 illustrates the GUI’s capabil-

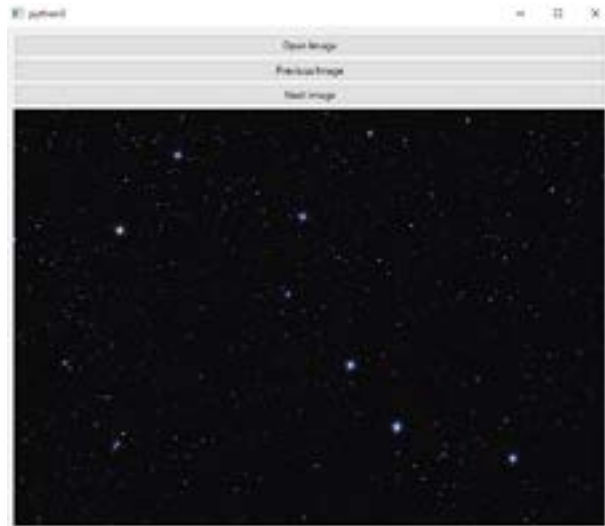


Figure 3: Little Dipper w/o Adaptive Threshold

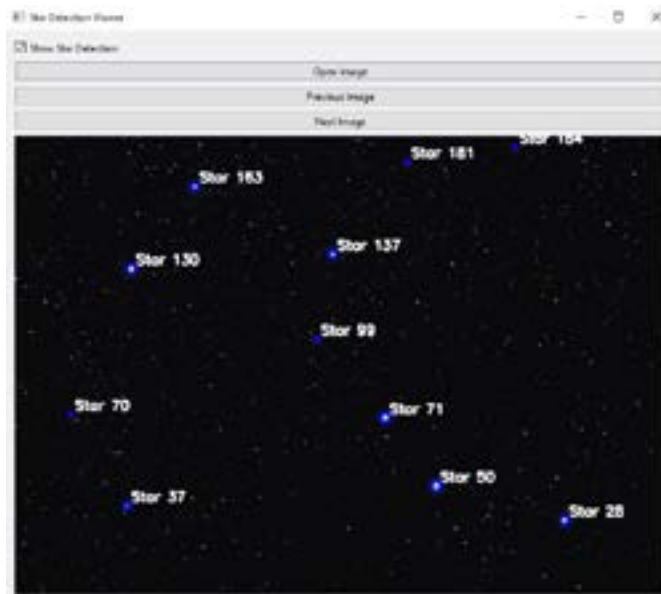


Figure 4: Little Dipper w/ Adaptive Threshold

ity to present information on a specific star upon entering its HIP number. The display encompasses the star's designation and its celestial coordinates, which serve as foundational data for subsequent computations of its Earth-relative position. This information is instrumental in aligning the drone for optimal sky observation.

The initial step involves converting the observer's geographic coordinates (latitude, longitude, altitude) into Earth-Centered, Earth-Fixed (ECEF) coordinates, establishing a precise starting point for further calculations:



Figure 5: StarFinder returning Celestial Coordinates for 'Alpha Ursae Minoris'

$$x = (N(\phi) + h) \cdot \cos(\phi) \cdot \cos(\lambda), \quad (1)$$

$$y = (N(\phi) + h) \cdot \cos(\phi) \cdot \sin(\lambda), \quad (2)$$

$$z = \left(\frac{b^2}{a^2} N(\phi) + h \right) \cdot \sin(\phi), \quad (3)$$

where ϕ and λ represent the observer's latitude and longitude, and h is the altitude. $N(\phi)$, the prime vertical radius of curvature, is integrated into the computations to account for Earth's oblateness. This ensures the celestial coordinate calculations accurately reflect the true positions of stars as observed from an ellipsoidal Earth, which is essential for the drone's precise aiming and tracking.

2) *ECEF to ECI Coordinate Transformation:* The transformation from Earth-Centered, Earth-Fixed (ECEF) to Earth-Centered Inertial (ECI) coordinates is crucial for celestial observations. This step aligns the observer's position with the inertial reference frame used for celestial tracking, considering Earth's rotation through the Greenwich Mean Sidereal Time (GMST), thus ensuring accurate positioning of celestial objects relative to the observer.

Given a position in ECEF coordinates, the transformation to ECI coordinates is as follows:

$$X_{ECI} = X_{ECEF} \cdot \cos(\theta_{GMST}) + Y_{ECEF} \cdot \sin(\theta_{GMST}), \quad (4)$$

$$Y_{ECI} = -X_{ECEF} \cdot \sin(\theta_{GMST}) + Y_{ECEF} \cdot \cos(\theta_{GMST}), \quad (5)$$

$$Z_{ECI} = Z_{ECEF}. \quad (6)$$

θ_{GMST} , the Earth's rotation angle, is derived from the current Universal Time (UT) and correlates Earth's rotation with the celestial reference frame:

$$\theta_{GMST} = \theta_0 + UT \cdot 1.00273790935 \times 360^\circ,$$

where θ_0 represents the GMST angle at 0h UT. This coefficient accounts for the slight difference between sidereal and solar time, acknowledging that a sidereal day is marginally shorter than a solar day.

This transformation ensures that the Kepler-22b team can precisely track celestial bodies by accurately aligning the observer's location with the inertial frame of the universe.

3) *Future Enhancements in Celestial Tracking and Observation:* The development of StarFinder and the integration of advanced computational techniques for celestial tracking lay the groundwork for future enhancements in the Kepler-22b project. The team envisions further refinements in the gimbal and gyroscopic systems for improved image stability.

C. Client and Server Framework

For effective real-time operation, the drone's base station and companion computer require a reliable method to run Python code concurrently, ensuring seamless communication between code nodes. While developing the video streaming Python script, the decision to use `asyncio`, as suggested in web socket documentation, was revisited. Though `asyncio` is recommended for handling multiple clients due to its efficiency, the team found threading a more suitable alternative given our specific use case with the Raspberry Pi acting as the sole client to the GUI. Familiarity with threading, compared to the `asyncio` library, influenced the Kepler-22b team's preference, leading to threading being adopted as the primary solution for parallel code execution.

The solution to the challenge of how different threads share information to capitalize on parallel processing was found in the threading documentation. The `queue` library presented a thread-safe method for data exchange between threads, which was particularly useful as a buffer for video communication.

Video server and client functionalities were achieved by developing two separate class scripts that integrated `queue`, `WebSockets`, `numpy`, `OpenCV`, and `threading`. The video server script continuously waits for a client to connect. Upon establishing a connection, data is decoded into a

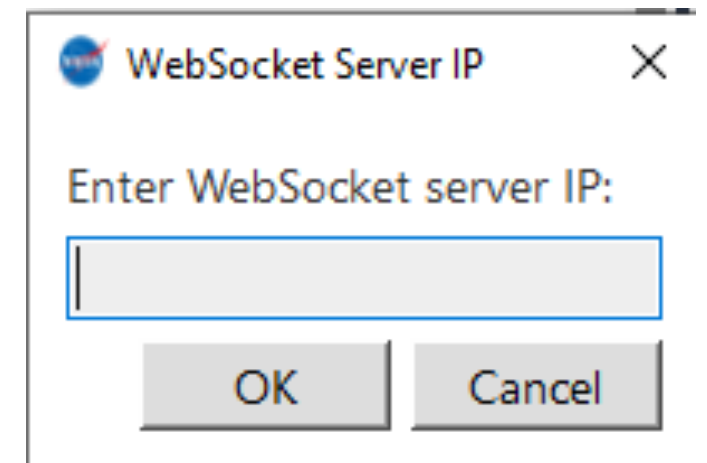


Figure 6: GUI prompt for server connection

`numpy` array for `OpenCV` processing and queued for frame-by-frame streaming. The queue's FIFO (First In, First Out) method simplifies the retrieval of the earliest added frame, enhancing the video streaming process. To address potential GUI crashes due to video server disconnections, a static image is displayed as a placeholder until video streaming resumes, preventing flicker caused by latency issues. Figure 7 shows the flow of the system.

1) *Text-based and High-altitude Communication:* Text-based communication was established using Python sockets, facilitating straightforward data exchanges in JSON format between the Raspberry Pi 5 and the base station. This method allowed the server side to manage connections efficiently, reducing resource usage on the GUI when issuing commands. Utilizing queues for data sharing between threads ensured a smooth flow of commands to the gimbal controls, enhancing operational smoothness.

For confirming motor positions and data from the Arduino controlling the gimbal, these devices connect to the Raspberry Pi via UART protocol, with data formatted in JSON for GUI display. This allows the operator to easily control the devices without needing knowledge of command line or coding languages.

Cellular data was chosen for lower-altitude communication due to budget constraints. Despite its effectiveness at lower altitudes, communication becomes unstable beyond 2000 feet, raising concerns over data transmission reliability. For higher altitudes exceeding the line of sight, satellite communication modules offer a solution at the cost of increased latency but ensure more dependable data

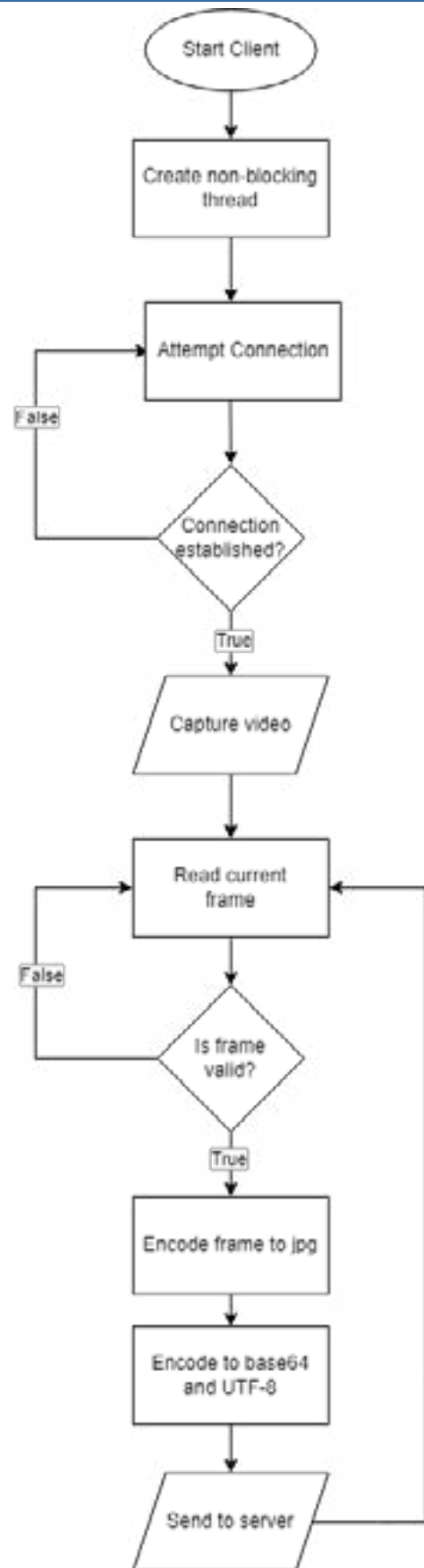


Figure 7: Flowchart of Client to Server Communication

transfer. Under such conditions, the drone relies on navigation software implemented in the Flight Controller for autonomous continuation of the flight or return to the base.

This meticulous approach to our onboard communication and data processing is pivotal for guaranteeing both reliability and optimal performance in the future. Communication stands as a cornerstone of our design, with its importance underscored by the potential for catastrophic consequences in the event of a failure. Fortunately, the Kepler-22b project is poised for robustness, benefiting significantly from the dedicated focus on crucial aspects of the design.

VII. CONCLUSION

In conclusion, while significant progress has been made in various aspects of the project, there are several critical areas that still require attention and further development.

Firstly, the section on cellular communication remains a work in progress. Implementing a SixFab module would greatly enhance our ability to communicate effectively with the drone, particularly in remote or challenging environments.

Secondly, the GUI, although functional, requires updates to ensure seamless and near-real-time video streaming without any lag or slow responses. This optimization is crucial for enhancing user experience and maximizing the effectiveness of the drone's operations.

Thirdly, it is imperative to establish contingency plans for scenarios where communication with the drone or video streaming from the client and server is lost. Developing robust protocols and procedures for such situations will help mitigate risks and ensure the project's reliability and resilience.

Lastly, there is a compelling opportunity to explore the integration of YOLO and SkyField Detection to work synergistically. By combining the capabilities of these two technologies, we can enhance the accuracy and efficiency of star constellation detection, further advancing the project's objectives in celestial observation.

In summary, while there are challenges ahead, addressing these areas of improvement will undoubtedly contribute to the overall success and impact of the Kepler-22b project. Through continued collaboration, innovation, and perseverance,

we remain committed to achieving our goals and pushing the boundaries of technological innovation in space exploration.

VIII. ACKNOWLEDGEMENT

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Furthermore, I extend my heartfelt appreciation to my family and my fellow McNair scholars for their unwavering support, personal advice, and unwavering presence during both the highest and lowest moments of my journey.

Lastly, I would like to acknowledge the McNair Program and NASA for their generous funding and ongoing interest in the project's expansion. Their support has been crucial in fueling our aspirations and driving the project towards greater heights.

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Turnage
Kayla Xenotransplantation: An Alternative Solution to the National Organ Shortage

Abstract

Many people in the United States are living with debilitating diseases and other conditions that permanently damage vital organs such as the heart and kidneys, leaving them with organ transplantation as the only option for long-term survival. Because of this, there is an imbalance between available matching human organ donors and organ transplant demand in the United States, making the national transplant waiting lists several years long. Scientists are exploring viable alternatives to human organ transplantation to address the waitlist issue. Cross-species transplantation, commonly known as xenotransplantation, may be an attainable solution to address the national organ shortage. Advancements in modern medicine, specifically in biotechnology, have made exploration of xenotransplantation possible. Recent surgical procedures specifically utilizing genetically modified pigs raised in pathogen-free facilities have been conducted in an effort to strengthen the case for human clinical trials. Organ xenotransplantation contains notable risks and benefits and is generating discussions of the ethics surrounding its procedures, the future of organ transplantation, and whether this research will benefit human health and extend life in the future. This paper will argue that xenotransplantation is a viable option for addressing the national organ shortage, and that funding should be increased to further research and develop the infrastructure needed to support it.

Xenotransplantation: An Alternative Solution to the National Organ Shortage

In the United States, the majority of adults (approximately 95 percent) are in support of organ donation. However, only 54 percent (about 170 million people) are actual registered donors (Penn Medicine Transplant Blog, 2022). In addition to this, there are an extremely specific set of circumstances that allow a deceased organ donor to become eligible for donation. Even though the individual may already be registered as a donor, they must sustain a non-survivable injury, experience brain death, meaning absence of all neurologic function, or die in the hospital while on ventilated support. Timely evaluations of deceased donors are critical as organs can quickly become nonviable in a matter of hours. Because of this, deceased donation is rare and only one percent of eligible donors’ organs can be used (LifeSource, 2021). Presently, the demand for organs significantly outweighs the supply resulting in immensely long transplant waitlists. According to the Organ Procurement and Transplantation Network, nearly 106,000 men, women, and children are on the United Network for Organ Sharing (UNOS) list with 17 individuals dying every day waiting for transplantation (HRSA, 2022). Of the more than 41,000 transplants performed in the U.S., over 60 percent were kidney transplants making it the most commonly transplanted organ. In 2021, 90,483 patients were on the kidney transplant waiting list and while more than half of allografts (same-species organ donation) carried out in 2021 were for kidneys, only 21 percent of patients requiring kidney transplants were able to receive an organ (HRSA, 2022).

In September of 2023, President Biden signed into law H.R. 2544: “Securing the U.S. Organ Procurement and Transplantation Network (OPTN) Act.” This law will “expand the pool of entities that can contract with the OPTN and modernize the system to further protect and expedite the organ transplantation process” (IHPL, 2023). While this should improve the current

procurement system, it does not increase the number of available organs for patients. With the intention of combating the bottlenecking due to accumulation of patients on the organ donor waitlist, medical scientists and surgeons have been researching other options for organ transplantation and have found that animals with similar organ morphology to humans are a possible alternative – this is known as xenotransplantation. According to the Food and Drug Administration (FDA), any procedure that involves the transplantation, implantation or infusion of live cells, tissues, or organs from a nonhuman animal source, or human body fluids, cells, tissues, or organs that have had contact outside the living body with live nonhuman animal cells into a human recipient qualifies as xenotransplantation (CDC, 2022).

Argument

I am arguing that xenotransplantation is a viable option for addressing the national organ shortage and extending the lives of those who are in need of organ transplants. In this paper I will discuss some background on organ transplantation, notable instances of successful organ xenotransplantation, and advancements in medical technology that allowed progress in this field of study. I will then present arguments in support of my position, the corresponding objections and rebuttals, and close with policy proposals pertaining to my thesis.

Background

Xenotransplantation is not a new phenomenon; it is a continuation of past medical research. The earliest documented instance of animal-to-human transplantation was performed in 1838, which was a corneal tissue transplantation from a pig (Cooper, et al., 2015). Since the mid-1900s transplant methodology has been refined to increase organ and recipient longevity. In 1963 before chronic dialysis was widely used and human organs were in short supply, Dr. Keith Reemtsma at Tulane University believed an alternative to demise from organ failure was the

implementation of organs from an animal with close evolutionary relation to humans. In 13 patients, he completed dual kidney transplants sourced from chimpanzees. Most of his patients survived only four to eight weeks due to infections; however, there was one patient (a female schoolteacher) who survived for nine months and was able to return to work. It is stated that she remained “in good health until suddenly collapsing and dying,” possibly from an electrolyte imbalance (Cooper, et al., 2015). As organ xenotransplantation research progressed, it was found that pigs are the preferred animal for xenotransplantation because of their fast maturation rate, ability to produce large litters, and comparable organ size to humans. Though chimpanzees are more similar to humans genetically, their organs are too small and pose too much of an infectious risk to sustain human life (Levy, 2000). Dr. Muhammad Mohiuddin, director of the cardiac xenotransplantation program at the University of Maryland School of Medicine conducted extensive research on how genetically modified pig organs performed in baboons leading to historic progress in the first pig-to-human transplant in a living recipient in 2022 (Servick, 2022).

A major hindrance to successful animal-to-human transplantations are xenogeneic infections; these are diseases transmissible from animals to humans (FDA Backgrounder, 1996). Though pig organs are anatomically similar to humans, all organs sourced from this species contain porcine endogenous retroviruses (PERVs) within their genome (Denner, 2021). PERVs are “the result of a trans-species transmission of a retrovirus(s) from other species to pigs” (Denner, 2021) and introduce a major risk for development of infection or organ rejection in humans.

Development of genome editing technology in the 21st century further permits advancements in medicine and specifically addresses PERVs. Editing porcine organs with

Clustered Regularly Interspaced Short Palindromic Repeats, or CRISPR, technology is necessary because it increases organ compatibility and reduces the likelihood of rejection. CRISPR/Cas9 technology utilizes Cas9, an enzyme that can “cut” DNA sequences, and guide RNA that helps direct the enzyme to the target site (Doudna, 2017). By using CRISPR/Cas9, sequences of problematic genetic information can be deleted while others can be inserted (like the “find/replace” word processing feature). The 10-gene pig is the result of such genetic engineering. As the name suggests, 10 key genes (four pig and six human) were engineered to reduce risks of rejection and infection and make the organs better suited for the human body. “Four pig genes were inactivated, including ones that cause aggressive human rejection and continuous growth of the organ after implantation...” (Rabin, 2022). In preparation for a ground-breaking kidney organ xenotransplantation at the University of Alabama at Birmingham (UAB) in 2021, “three of the genes that were knocked out are carbohydrate antigens that have been known to result in hyperacute rejection... the fourth one was the growth hormone receptor, [and] that's knocked out to prevent the pig kidney from outgrowing its new host... The six human transgenes [are] all slightly different, but they're designed to down regulate inflammation [and] help with the complement cascade, basically to sort of immune modulate to try to dampen the human immune response to the pig's kidney” (Locke, Interview, 7 April 2023).

In September of 2021, the UAB was able to announce the first peer-reviewed research on a successful pig-to-human transplant of genetically modified, clinical-grade porcine kidneys into a brain-dead human recipient. It is stated that the kidneys remained operative (meaning they were able to filter blood and produce urine) until the study ended 77 hours after the procedure (Koplon, 2022). This was the world’s “first peer- reviewed and published study of a genetically modified pig kidney transplanted into the body of a brain-dead human recipient...and the first to

establish brain death as a viable preclinical human model” (Greer, 2022). The surgery was led by Jayme Locke, M.D., MPH, a professor and the director of Division of Transplantation, UAB Comprehensive Transplant Institute, and Incompatible Kidney Transplant Program in UAB’s Department of Surgery. In a video interview conducted with Dr. Locke, when I asked about her motivation behind researching xenotransplantation, she stated that “one of the hardest things is to see someone in [a] clinic and know that they're probably more likely to die than they are to get a kidney transplant. What we do is narrow that gap and solve that problem, that's really sort of the angle with which I came at xenotransplantation... We take all this extraordinary science people have done, and really translate it and get it into the clinic so we can help people” (Locke, Interview, 7 April 2023). Other instances of successful transplantation were performed at New York University in July of 2022, where two genetically modified pig hearts were transplanted into two brain-dead individuals (Lapid, 2022).

The first live organ xenotransplantation attempt was made at the University of Maryland Medical Center on January 7, 2022, where the first genetically modified pig heart was transplanted into a living recipient. Fifty-seven-year-old David Bennett had end-stage heart failure and few options for treatment because of his irregular heartbeat (arrhythmia) and noncompliance with medical instructions (The Associated Press, 2022). He opted for this experimental emergency procedure as a last-ditch effort and survived for two months. Since the FDA has not approved of genetically modified or pure animal organs for xenotransplantation into humans, the surgical team working on Bennett was required to submit a request under the FDA’s expanded access or “compassionate use” program. This program allows terminally ill patients who meet specific medical criteria to access drugs or procedures that are still in preclinical trial research stages (FDA Public Health Focus, 2022). Even though Bennett passed

away within months after his transplant, his surgery was still deemed a “success” by his surgery team at the University of Maryland because his death was not attributed to organ rejection or infection, but to abnormal electrical signals and heart rhythms (Fieldstadt, 2022).

Xenotransplantation Solutions

The reasons supporting my argument that xenotransplantation is a solution to the national organ shortage are the following: First, organs sourced from pigs would be more readily available than human organs, and the prospective cost savings associated with xenotransplantation are noteworthy. Due to pigs’ relatively short gestational period and large litters, production of porcine products like the genetically altered 10-gene pig could be scaled to meet the demand for organs.

Secondly, for kidney candidates alone, utilizing organ xenotransplantation could potentially reduce the national expenditures of dialysis treatments because the organs would be available immediately, potentially saving hundreds of thousands of dollars per patient. We must consider the existing costs of waiting for an organ transplant. For example, 15 percent of people living in the U.S. have chronic kidney disease (CKD) and 750,000 have life-threatening end-stage kidney disease (ESKD) (CDC, 2022). More than 70 percent of people with ESKD receive dialysis regularly with average individual outpatient costs being 172,800 dollars annually. With transplant candidates waiting an average of three to five years for organs, total spending costs can be between 518,400 dollars and 864,000 dollars before the transplant surgery (Hedt et al., 2021). These dialysis costs are in addition to the cost of the actual transplant surgery, which on average is more than 400,000 dollars (Michas, 2022).

Because advancements of xenotransplantation are progressing rapidly and the use of genetically modified porcine organs are relatively new, there is little documented about per-

patient costs. There is, however, discourse regarding potential similarities in the transplant procedures and associated surgical costs between human-to-human organ transplantation and pig-to-human organ transplantation. In a recent publication by the National Library of Medicine, researchers argue that “currently, the cost of transplanting a pig kidney is thought to be at least as expensive as transplanting a deceased donor human kidney...” (Held et al., 2015).

Infrastructure expenses aside, there are potentially significant savings in the areas of organ preparation, transplantation, and other associated costs when considering standard organ procurement from the limited human donor pool versus porcine organ retrieval from proposed, regional pathogen-free facilities. “Net savings to society from a single viable pig kidney could amount to 1.1 million dollars, with taxpayer savings per kidney of 146,000 dollars” (Bayliss, 2022). Dialysis is significantly more expensive than post-op care long-term because of continuous in-center visits spanning years at a time. Moreover, a kidney transplant is almost four times less expensive per quality-adjusted life-year than dialysis therapy (Held, 2015).

Given the high costs of dialysis, I would argue that if the government invests in the infrastructure to make regular use of organ xenotransplantation a reality, this could reduce the number of individuals on dialysis, lower annual dialysis-related expenses, and reduce the national organ transplantation waitlist. Currently, the United States taxpayers, through the federally funded senior insurance Medicare program, cover a significant portion of the costs associated with dialysis for a number of patients. Presently, more than 24 percent of total Medicare spending (more than 130 billion dollars) is allocated for patients with kidney disease. Furthermore, seven percent of Medicare spending goes towards one percent of Medicare beneficiaries who are affected by ESKD. The National Kidney Foundation states that failure to address the progression of kidney disease and the spending for kidney failure treatment could

potentially bankrupt the Medicare Trust Fund (National Kidney Foundation, 2023).

Lastly, the donor shortage has been an issue in the U.S. for decades, so the medical community is looking for ways to expand the list of viable organ donors. With healthy donors and organs discarded due to failure to meet the rigorous condition standards set by the Health Resources and Services Administration (HRSA), researchers are considering using organs from “marginal donors.” This includes adult donors who are older, diabetic, have hypertension, and even those who had the genome-1 Hepatitis-C Virus strain (HCV) (Hunton, 2016). While transmissions of these infections can typically be cured post-transplant surgery with antiviral drugs (Harris, 2019), it still raises ethical concerns about the condition of the organs and the decision-making on who receives a “pristine organ” versus one carrying a virus. Using genetically modified porcine organs would offer certain assurance to candidates with respect to consistency of the organ quality.

Objections and Rebuttals

There are several medical and ethical controversies surrounding organ xenotransplantation. Discourse on new or emerging technologies has a propensity for consequentialist argument structure and xenotransplantation is no exception. There are generally two prevailing stances with new advancements in science and technology, proponents and opponents, where the former regards the debated technology with optimism and the latter is more skeptical of the direction, intention, or consequences of said technology (Rip A., Swierstra T., 2007). At face value, utilizing xenotransplantation to combat the national organ shortage is “good” for humanity. However, underlying ethical concerns muddy the arguments in favor of this field of study. Three objections to xenotransplantation I wish to highlight are: medical concerns regarding rates of organ rejection in xenotransplantation, the use of non-animal

alternatives to organ transplantation, and general public acceptance of practicing xenotransplantation.

Organ Rejection Rates

In non-genetically modified animal organs used in xenotransplantation, there are impending medical issues with the procedure; application of genetically modified porcine organs in medical research has only recently gained momentum within the last few years (Loike, et al. 2018). As with intra-species organ transplantation, the biggest obstacle is organ rejection as the human immune system sees the transplant as foreign and attacks it. According to the Donor Alliance, human-to-human organ rejection is common; approximately 15 percent of recipients experience acute rejection within the first three months, and 50 percent do after 10 to 12 years with the transplanted organ (Donor Alliance, 2020). Concrete data on rejection rates for organ xenotransplantation are still developing with this nascent medical procedure. As it stands, there appears to be reoccurring patterns of rejection with some genetically modified organs that fall under the classifications of hyperacute xenograft rejection, acute humoral xenograft rejection and acute cellular rejection (Lu T., et al., 2020). Essentially, within minutes to hours the transplanted xenografts are destroyed by human antibodies and whole transplanted organs can be rejected after days to weeks following a transplant. Because of this, some medical professionals hold the opinion that until the rejection rate can be consistently addressed, xenotransplantation clinical research should be reserved for brain-dead recipients (Lapid, 2022).

My response to this argument is backed by advancements in genome editing technology. Amidst the recent strides made in organ xenotransplant procedures, the utilization of CRISPR/Cas9 has demonstrated the ability to prevent previously identified porcine viruses from infiltrating the human immune system. As research continues, it is likely that medical

professionals will find more information that results in understanding and identifying other genetic sequences that can be removed or added to improve organ compatibility.

Non-Animal Alternatives

Xenotransplantation has received strong pushback by some regarding killing animals for medical research. Consequently, an objection to this type of research is to explore alternatives to organ xenotransplantation such as three-dimensional bioprinted (3D bioprinting) organs or bioartificial kidney implants. Bioprinted organs are created through cytoscribing; this is the method used for positioning cells into prearranged patterns with microscopic precision. Cell adhesions and antibodies are then deposited using computer programming paired with depositing layers of bioplastics to create a “skeleton” of the selected organ. The corresponding cells are then transferred into the organ “skeleton” to generate a functional organ (Tang, 2022). 3D bioprinting has seen massive technological breakthroughs in the areas of organ regeneration in recent years and has the potential to help individuals who have lost tissues or organs from injuries. In theory, once 3D bioprinting is perfected, customized organs that match the recipient’s need can be printed on-demand. This cost-effective approach could drastically reduce the number of people on the transplant waiting list.

My response to this argument is that while recent advancements in bioprinting provide potential hope to address the organ donor shortage, the technology requires further development to create a larger variety of stable human organs. Currently, there has only been one successful 3D printed transplantation; a bladder transplanted in 2004 (Tang, 2022). Additionally, because of the lack of precision during the printing process, geometrically complex organs are difficult to generate using bioprinting technology (Bishop, et al., 2017). While organ bioprinting technology holds great promise, bioartificial kidney implants have yet to be approved for human clinical

trials (ASH Media, 2022). There are major technical issues to address before a viable major organ like a heart or kidney can be produced. Additionally, as with organ xenotransplantation, 3D printed organs have ethical and social concerns centered around access, regulation, and equity.

Even though the number of “successful” xenotransplantation cases involving major organs is small, until 3D organ printing can be perfected and replicated on a large scale, xenotransplantation using porcine organs may be the more viable option to address organs that are in higher demand like kidneys and hearts.

Ethical Concerns

Exploration of organ xenotransplantation has presented some extremely useful information to professionals in the field of transplantation. The past five years alone have demonstrated through various animal trials, brain-dead human recipient preclinical trials, and an FDA emergency use exception, that xenotransplantation may soon be included with traditional human organ transplantation. The advancements and knowledge gained supports the notion that genetically modified pig organs may become an effective alternative for addressing the national organ recipient waiting lists. This form of research, however, faces serious ethical concerns in a number of areas. General acceptance of organ xenotransplantation may vary among different groups in society. While some religious individuals and animal rights advocates may be against any form of research that involves the killing of animals, others may have a more utilitarian perspective and believe that human life is intrinsically more valuable than an animal’s. If the immediate societal result of a debatable technology is overall improvement of human health, those who align themselves with the latter sentiments may view this research more positively. While organ xenotransplantation is still in trial stages, questions of who will be participating in

clinical trials and who will eventually be eligible for the genetically modified organs remains uncertain; utility, equity, and justice are other areas generating significant debate as well.

Policy Proposal

From a policy standpoint, I am advocating for four actions: increased funding for organ xenotransplantation research, expanding the number of pathogen-free facilities, increasing clinical trial volunteers by providing patients Advanced Health Directive options to include xenotransplants, and expanding FDA compassionate use cases. In the long term, I believe the utilization of pig organs (especially kidneys) in xenotransplantation has much potential, and funding from both the private sector and the federal government can accelerate progress of research.

Increased Funding

In 2016, the Comprehensive Transplant Institute at the University of Alabama at Birmingham was awarded a five-year, 19.5-million-dollar grant from biotechnology company United Therapeutics Corporation. The grant was provided to specifically establish the UAB Xenotransplantation Program. UAB and United Therapeutics had the shared goal of making major advances in the field with the target milestone of performing transplants using genetically modified pig kidneys in human models by 2021 (Greer, 2016). The program successfully achieved the goal with the September 2021 xenotransplant porcine kidney into a brain-dead recipient who donated their body. Private sector funding similar to what was awarded to UAB would enable further advancement for xenografts and should be expanded to gain more knowledge.

With respect to government financial support, I suggest an increase in federal funding, specifically earmarked to make additional advancements in xenotransplantation, which can yield

major dividends. Currently, 64 percent of applied biomedical research and development funding comes from industry while only 22 percent from the federal government through grants. If the U.S. government increased funding to address alternative organ transplant research to include expanding human clinical trials and making other advancements in xenotransplantation, the future cost savings to the government would be significant. As mentioned, 24 percent of the Medicare budget is currently allocated for dialysis. If investments to make advancements yield promising results, the cost savings associated with reducing the \$130 billion spent on dialysis can be considerable (National Kidney Foundation, 2023).

Expand the Number of Pathogen-Free Facilities

In addition to increasing financial investment in xenotransplantation, more pathogen-free facilities to supply genetically modified animal organs should be developed. These are facilities free from any viruses, bacterium or other germs and allow genetically modified animals to be housed, bred and sustained in a sterile environment. Biosafety is paramount for organ xenotransplantation trials. Designated pathogen free (DPF) pigs that are used for xenotransplantation must be raised and bred in a controlled pathogen-free environment, maintained following animal welfare and FDA standards. To ensure that known pathogens are not found in animals, they are also monitored and tested under extensive bio secure measures (Science Learning Hub, 2011). Increasing the number of facilities throughout the United States may help with organ procurement as shorter distances would be traveled between hospitals and facilities.

Recruitment of Volunteers - Advance Directive Options

In recent years, significant advancements in xenotransplantation have been made. However, more information must be gathered on human subjects. To increase the number of volunteers, I

would advocate for more proactive steps to be taken for expanding the list of potential organ xenotransplantation recipients to include brain-dead and living patients. To make the case for living recipients and ensure that the transplantation is safe, more research using brain death as a preclinical model (Locke, Interview, 7 April 2023), similar to the trial completed at UAB, would need to be approved. A way to increase the number of potential brain-dead recipients could be to include a “full body donation” option to current Advanced Health Directive (AHD) forms. While each state has its own version of the AHD, most forms include options for: requesting life-sustaining treatments (like CPR), declining life-sustaining treatments, and a category entitled “Other” (American Bar Association, 2018). This form of donation could be an additional option within the “decline” portion. After trials, if organ xenotransplantation is determined to be safe for living recipients, an updated directive (for example one specifying porcine xenotransplantation) within the “life-sustaining” category could increase awareness, as well as potential recipients.

Increase FDA Compassionate Use Cases

Increasing the number of living patient volunteers can lead to an increase in FDA Investigational New Drug (IND) applications, thus allowing more FDA compassionate use authorization cases similar to David Bennett’s. Whether using living or braindead human models, permission from the FDA and an IND is required. FDA approval is a lengthy and costly process. There are four major components to complete which could span decades: the preclinical phase, the IND Application, clinical trials, and the biologics license application.

The preclinical phase involves testing products in labs and on animals. In order for genetically modified pig organs to be approved as a product, there would have to be non-human species testing to show that the “product” is safe for human trials (Balamut, 2022). The second step requires a detailed submission of the composition of their product as well as the results from

the preclinical tests and fully organized plan for human clinical trials; this is known as the Investigational New Drug Application (IND). Once that is approved, the third component, which is clinical trials, can begin. This consists of three parts: finding volunteers to test the biologic products safety, employment of patients to showcase the overall effectiveness of the product(s) in question, and examination of the side effects and other results of the products. Lastly, there must be an extensive Biologics License Application (BLA) which includes the data collected from the clinical trial, product labeling, and other pertinent information (Balamut, 2022).

The pig-to-human heart transplant performed on David Bennett was revolutionary as it was the first organ xenotransplantation that used a genetically modified pig heart into a living human recipient. However, Bennett’s surgical team was initially turned down because the FDA wanted to ensure that the pig involved in the procedure would come from a medical-grade facility. Additionally, the FDA wanted 10 successful pig-to-baboon transplants performed before trying with humans (Servick, 2022). It was through the FDA’s “compassionate use” program that Bennett was able to receive this life-saving procedure. Under this program the FDA “may authorize unapproved medical products or unapproved uses of approved medical products to be used in an emergency to diagnose, treat, or prevent serious or life-threatening diseases or conditions provided that certain criteria are met, and there are no adequate, approved, and available alternatives" (FDA, 2022).

The expansion of living recipients for organ xenotransplantation clinical trials can be proactively mined from the organ donor waiting list. Providing those organ donor candidates, especially those who are much lower on the list and where certain death is imminent as with Mr. Bennett, the option of volunteering for porcine organs can dramatically increase the pool of recipients. As with any major surgery, especially a transplant procedure, the recipient would be

told the risks involved and rate of survival. Kidney damage cannot be reversed, so patients are searching for relief from chronic kidney disease symptoms which can include nausea, vomiting, fatigue, chest pain, shortness of breath and a host of other physical and mental symptoms. Additionally, patients are looking to end the expensive, often physically grueling dialysis treatments. Overall, patients undergoing human organ kidney transplantation experience improved quality of life as compared with those being subjected to chronic dialysis treatment (Mayo Foundation, 2023). In a review of several studies involving over 1.9 million participants, it was found that significantly lower mortality and increased benefits included lower risk of cardiovascular events the longer the transplanted organ was in place (Tonelli et al., 2011). The goal among scientists is that the promise of perfecting organ xenotransplantation will lead to similar post human transplantation quality of life improvements in their patients. Doctors and waitlisted patients are following the gains made in research and await solutions to reduce the organ wait times. Following the publication of UAB’s ground-breaking organ xenotransplant on Jim Parsons to “establish brain-death as a viably safe and feasible preclinical model” (Lock, American Journal of Transplantation), the UAB clinic reported an increase of clinic patients requesting to be among the first to be included in a study to have a “pig kidney” (Locke, Interview, 7 April 2023). By increasing more compassionate use cases, more data can be collected on the effectiveness of genetically modified porcine organs in humans.

Conclusion

In summary, the ongoing national organ donor shortage is a major health crisis and while there are various developing prospects for addressing this issue, the recent advancements in organ xenotransplantation make it a leading candidate for addressing the shortage. With the advancement of modern technology, scientists have been researching the efficacy of genetically

modified pig organs used for xenotransplantation in both animal and human models. An increase in federal funding to expand research coupled with FDA authorization to allow more groundbreaking xenotransplants and recruitment of volunteers for organ xenotransplantation will aid in accelerating the progress of research, potentially benefiting human health and extending life in the process.

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Vasquez Celeste Understanding Wealth Inequality: Mexican American’s Experiences in Accessing Wealth

Abstract-

Accumulating wealth is challenging as it requires a lifetime of commitment however, the obstacles that exist among the Mexican American community are exceedingly different in comparison to their White counterparts. Wealth comes with knowledge, skills, privilege, status, power, and leverage. Wealth is accumulated through obtaining assets and measured through an individual’s net worth. Assets can include housing, checking accounts, investments, and vehicles. As I Identify as Mexican American, I want to understand what the Mexican American Community encounters when attempting to obtain wealth. Drawing on in-depth interviews with Mexican American adults, this study asks: What are the challenges Mexican Americans encounter in acquiring wealth? Despite these challenges, how do Mexican Americans build their financial literacy and obtain wealth? How does class status contribute to Mexican American’s experience in building Wealth? How does family impact Mexican American's experience in wealth attainment? This research will demonstrate the navigational strategies Mexican Americans utilize to generate wealth. Moreover, it will deepen our understanding of Mexican Americans’ social mobility and striving toward further economic power and freedom.

Research Problem: Introduction

America is recorded to have the most millionaires and billionaires in the world (Chloe Berger 2023). America also has a high level of wealth inequality amongst all developed countries. The top 10% of wealthy families on average make 18.78 times more income than the lower 10% of families (Keister & Southgate 2022). Although these billion and millionaires are making 18 times more than the average worker, it does not capture the full picture of wealth. Income is commonly depicted as wealth and yes, income is a form of wealth, but wealth is not just income. Wealth is measured as a sum of an individual’s assets (Keister & Southgate 2022). This includes one’s income, savings, cars, land, and more. According to Federal Reserve Bank of St. Louis, there’s a significant gap that exist between the average Hispanic family and white family. Although there has been an 60% gain in the average Hispanic family's wealth from 1989 to 2019, the average Hispanic family makes 38,000\$ a year while white families make 184,000\$ (Kent 2020). This statistic illustrates that there’s a 76 percent wealth gap that exist between Hispanic families and White families. It is important that we as a collective understand the factors that shape Hispanics experience in navigating wealth, essentially, establishing there is an active wealth gap in the Hispanic Community. With my positionality, I will be focusing on the Mexican American Community. Based off my research, I have found the importance of education, financial literacy, and family in shaping the Mexican American experience in wealth attainment. I will go further into these factors in my literature review.

Literature Review:

How does wealth accumulate?

When discussing wealth there is this misconception that it is primarily based off income however, there are many aspects when identifying wealth. Wealth is usually measured as an individual’s net worth. Therefore, items to consider when looking at one’s financial standing are their home, checking accounts, investments, and vehicles. Some uncommon assets that are tangible in high-end households are business assets, thoroughbred horses, valuable art and jewelry, and yachts (Keister & Southgate 2022). These assets accumulate to an individual’s short and long standing of financial stability in terms of objects. However, wealth impacts the social standing of an individual. Wealth comes with knowledge, skills, privilege, status, power, and leverage. Wealth provides resources to varies aspects of life including education, business, health, and more (Oliver & Shapiro 1995).

Financial Literacy-

Financial literacy plays a huge role in building wealth. Walden University Finance Professor, Darry Williams, defines financial literacy as having the skill to read, examine, maintain, and to talk about personal financial circumstances that influence one’s quality of life. This includes the ability to make financial decisions, and talk about financial issues while overcoming any discomfort, to plan long-term, and acknowledge life events that involve day to day financial commitment (William; Grizzell; Burrell 2011). The information that financial education provides comes a long way as it guides individuals on their pathway to success. It provides knowledge on

navigating debt, understanding the idea of investing, purchasing and financially managing a home, retirement and more. (William; Grizzell; Burrell 2011). The skills that are taught through financial literacy help obtain assets like homes, cars, investment products. Essentially, helping with accumulating wealth.

TIAA Institution (P-Fin Index) wrote report on the financial well-being of Americans in 2023. TIAA does an index survey to examine individuals' financial literacy using 28 questions for participants to illustrate at what levels they are in financial well-being. The data showed: 38% of Hispanics could only answer 8 to 14 questions correctly in the 28-question survey; 33% could answer 0 to 7 questions; 23% could answer 15 to 21 questions; and 6% could answer 22 to 28 questions. In contrast to their Asian, Black, and White counterparts, Hispanics were 2nd to Blacks in demonstrating that they had a small number of individuals that had strong levels of financial literacy and they had large amounts of individuals that demonstrated extremely low levels of financial literacy. Thus, establishing the importance of financial literacy, as there is a lack of financial well-being the Hispanic community. Unfortunately, I do not have direct information on how financial literacy impacts the Mexican American. Therefore, I will be using these statistics of the Hispanic Community to emphasize the significance of how financial literacy impacts the Mexican American Community.

Lack of financial literacy can lead to an increase in economic hardships. These hardships can vary from student debt, predatory loans or credit, credit debt, etc. Essentially, Mexican

Americans become vulnerable to financial circumstances and limit their children’s access to wealth attainment.

Education-

The Mexican American’s community in education is historically unjust in the United States however, it does not take away the significance of it. Therefore, I will go over the historic events that have contributed to the community's educational inequality. During the Civil Rights Movement, the Mexican American community faced battles in segregated Hispanic schools. School Boards petitioned for Mexican American students to be segregated to assimilate them to the American culture faster. They used culturally biased I.Q. tests to support these claims. However, the I.Q. test was purposefully modeled with information that white students would be more familiar with (Dave Roos 2023). Mendez v Westminster case brought attention to the educational neglect these students experienced at these segregated schools (Dave Roos 2023). Mendez described the school materials as, “two wooden shacks, the books were ‘hand-me-downs’ and the desks were ‘all falling apart” (Caitlin Yoshiko Kandil 2016). The curriculum was centered around learning domestic and industrial skills rather than reading and writing. These schools were created to program Mexican Americans to fulfill domesticate or agricultural labor. Mendez parents fought in court to place her in a white school for equal education. Supreme court ruled in a unanimous decision that “separate educational facilities are inherently unequal.” (Caitlin Yoshiko Kandil 2016). The Mendez v Westminster case initiated the desegregation process within schools. This case has been crucial in impacting Mexican American’s experience in navigating education as they face more economic and social hardships.

Studies show that Mexican American children are influenced by family in pursuing education. The majority of these families are working class, making their families support in academics less visible due to their economic conditions. The class difference from working class involvement with academics varies from the middle class interactions (Deeb-Soss; Manzo 2020). Middle class interactions are presented through “meetings, conferences and one-on-one consultations with teachers; tutoring; and volunteering at school” fam; Epstein 1995). While working class parents instill the value of hard work at home (Deeb-Soss & Manzo 2020). These skills can help Mexican American students navigate social institutions like education however, it does not reduce their hardships in trying to be successful in these systems. These traditional middle-class values are catered for in education. Unfortunately, working class [which is often associated with Hispanic] values are criticized and less catered to in social institutions like education thus linking Hispanic students to face more hardships. These hardships of education can lead to students becoming less involved and successful in education, therefore, contributing to the achievement gap.

The US Department of Treasury illustrates the active achievement gap in the Hispanic Community. This presents data on the following races: Hispanic, Asian, black, Native Hawaiian, American Indian, White, and other races. Statistics show that 75% of Hispanics have completed high school in 2021. In comparison to the other races, Hispanics have the lowest completion rate of High School. In the same study it demonstrated that only 20% of Hispanics obtain a bachelor's degree as of 2021. This percentage is rated at the same level with American Indian/Alaskan communities however, it is still the lowest completion rate in comparison to other races.

Education draws on wealth attainment because it shapes your quality and accessibility to jobs, annual income, and assets. Public Policy Insititute of California recent data presents the

relationship between wealth and degree attainment. Workers with a bachelor's degree earn 62% more than those with a high school diploma as of 2021 (Mejia; Perez; Hsieh; Johnson 2023). This data also showed that workers with a bachelor's earned an annual income that ranges from 50,000\$ to 130,000\$ while workers with a High School Diploma earned an annual income 30,000 to 65,000\$. In addition to that, workers with a bachelor's degree had greater success in the job market with benefits of paid time off, health insurance, retirement, and flexibility (Mejia; Perez; Hsieh; Johnson 2023). Essentially, confirming that education impacts your access to the job market, which shapes your annual income. If you are not making adequate income, it hinders your resources and access to wealth attainment. However, it is noted that economic and social hardships have hindered Mexican American’s success in education.

Family-

In the Hispanic and Latino community, there is a misconception that family represses individuals' mobility socially and economically. This concept is driven by “deficit thinking” which is typically applied to educators' perception of scholar's success. Educators often link scholars' success to their environment, specifically their families. This thinking has left students who come from a disadvantaged background as a target as educators blame their parents and scholars themselves for their failures (Valencia, Valenzuela, Sloan, & Foley, 2001). Marginalized students are vulnerable to educational or social hardships; making them a prime target of deficit thinking. Literature has proven Latino’s and Hispanics are impacted by this mindset as it’s derived from traditional forms of capital [depended on the middle & upper class] and racial notions of marginalized groups like Hispanics/Latino’s (Yosso 2005; Deeb-Soss & Manzo 2020) Fortunately, research has shown that Hispanic communities like Mexican American’s instill different skills and values due to economic and structural challenges (Deeb-

Soss & Manzo 2020). As mentioned in the education portion of the literature review, working class Mexican parents can instill the value of hard work at home as they cannot guide their children through educational hardships, in the same way middle class parents can. However, these values can be just as powerful as the values of middle-class individuals (Yosso 2005). Therefore, this research proves that notion of familial impact on individuals' perceptions, values, and consciousness.

Tara Yosso was able to acknowledge this influence of familial capital and deficit thinking. Yosso draws on how family can cultivate individuals' sense of “community history, memory and cultural intuition” (Yosso 2005). This model of kinship teaches individuals lessons on “caring, coping and providing (educación-education)” which influence “our emotional, moral, educational and occupational consciousness” (Yosso 2005; Delgado Gaitan, 1992, 1994, 2001; Elenes et al., 2001). Individuals then utilize this knowledge to their real live experiences (Yosso 2005). This framework guides the claim of how family impacts an individual's lifestyle. As family impacts your morals, perceptions, and consciousness, these are converted into actions. Therefore, family shapes your relationship with wealth attainment.

Theoretical -

Community Cultural Wealth

Tara Yosso is a sociologist that’s built her framework of Community Cultural Wealth off the intersectionality between race and capital (Yosso 2005). Specifically, Bourdieu’s idea of capital, stating that valuable capital is extracted from the upper and middle class. Bourdieu's argument leaves the assumption that People of Color lack capital. However, Yosso argues that people of color have other forms of capitals that are just as valuable. Yosso established 6

different forms of capital that are invaluable to marginalized communities and their experience in attaining cultural wealth. One of her main goals of this model was to dispute the racial notion that marginalized groups lack capital.

Yosso established 6 forms of capital: Aspirational, familial, social, linguistic, resistant, and navigational capital: Aspirational capital is the ability to dream and hope despite hardships; Familial capital is the cultural knowledge and experiences that shape by family; Linguistics is having innate or built social and communication skills by speaking more than one language; Social Captial the utilization of social contacts to navigate social institutions; resistant capital is the persistence and power of challenging injustice and subordination; and navigational capital is building strategies and skills to maneuver social institutions that aren’t always built in people of color favor (Yosso 2005).

I’ll be applying this framework to analyze how participants use their cultural experiences and transform them into skills and motivation to succeed in varying spaces to increase their chances of social mobility and wealth attainment.

Methods:

I performed in-depth interviews with 7 individuals who are Mexican American and are between the ages of 30 to 50 years old. Participants also fell in between the generations of 2nd generation, and beyond which is individuals whose parents were born in Mexico, but they were born in the United States. Participants were gathered through the sampling method Snowballing; therefore, they were recommended by my peers or family. Snowballing was the best method because my targeted population was difficult to recruit, as the topic of wealth is sensitive.

Participants were contacted after the referral with a brief screening process that was an email that asked them yes or no questions about their age, identity, and generation. After they confirmed that they met the criteria, they were sent a calendarly link and consent form to schedule a meeting with the options of in person or online interview. After the interviews were scheduled and IRB-approved waivers were successfully signed, I waited for the interview. Participants had time to review the consent form on their own with additional instructions to turn in the form with their signature and date.

At the interview, I reviewed the consent form verbally with all participants to ensure that they understood the terms and gave them room to ask any questions if needed. Once the paperwork has been thoroughly reviewed with the participant the interview began. Participants were given an opportunity before the interview date and at the beginning of the interview to establish any information they did not want to go over.

The interviewees were asked questions about their childhood, adulthood, access to education, money management, and class status. The interview focused on their experience with wealth and how their upbringing may have contributed to their wealth attainment. The interview length ranged from one to two hours. The data from the interviews were documented digitally along with any related files. All information from the research has been saved on a password-protected computer. Data and files are only accessible to Dr.Morales and myself. When analyzing the data, themes that occurred were how financial literacy impacted participants annual income, familial impact on money management, familial capital impact on educational success, etc.

Lastly, some ethical measures that were considered were how participants may have felt vulnerable when answering questions about finances or class status. They may be triggered with

talking about their childhood and may be in need of additional resources with someone to speak.

To counteract this issue, I ensured participants that all information will be secured, and identities will be hidden.

Findings:

Financial Literacy impact on participants Wealth Attainment:

Financial Literacy impact participants annual income

Financial literacy was linked to participants annual income. I rated participants financial literacy through 3 scales-low, mild, and high. This was demonstrated through money management practices and assets. If they relied on their budgeting and saving as forms of money management; relied on their paycheck as a source of income; and had assets like vehicle, they were rated as low. If they relied on their budgeting, saving, and investing as money management; relied on their paycheck as a source of income, and had assets like vehicle and home they were rated medium. If they relied on their budgeting, saving, and investing as money management; relied on their paycheck, passive income, and alternative occupations/part-time jobs as a source of income; and had assets like multiple vehicles, homes, and business(es) they were rated high.

- 1 out of 7 participants demonstrated low levels of financial literacy. These participants' annual income ranged from 20,000 to 30,000.
- 3 out of 7 participants demonstrated medium levels of financial literacy. These participants' annual income ranged from 90,000 to 130,000.
- 3 out of the 7 participants demonstrated high levels of financial literacy. These participants' annual income ranged from 110,000 to 305,000.

This draws on how financial literacy impacts participants' annual income. As demonstrated above, I saw a significant trend of participants' level of financial literacy impacting their annual income. The more invested or advanced they were with financial practices, the more likely they were to have a larger range of assets and annual income. Thus, supporting the previous of work of how financial literacy significantly impacts wealth attainment. Demonstrating high literacy in financial practices leads to an increase in asset attainment, and income.

Importance of Familial Capital:

Familial Capital impact on Money Management

This code establishes how families have the impact to shape how you perceive money and how you navigate obtaining assets. Therefore, it is important to establish skills in managing money at home. Participants illustrated that family instills your values and practices.

When I asked interviewees about the question below they responded with:

Are there any habits involved in money management that was passed down to you from your parents?

“Being punctual and having everything set aside for bills, food, and saving. They did [say], ‘hey, if you would want something, you need to save up first to get it’. They always implemented that to us.” -Leilani

Leilani demonstrates that her family taught her the importance of paying her bills on time and having enough to essentially live. In addition to that, her family was directly saying for her to get something she’d like outside of her means she has to save up for it. Her family has directly

impacted how she spends and understands money. They’ve also implemented the practices of budgeting and saving.

“Homeownership was a big one. I mentioned that he [his father] owns a couple commercial properties. He was just very into asset management, [he’d say], “ if you can [its] better to pay a mortgage and own it than to pay rent and not [own it].” That was a pretty big thing and I bought my first house when I was, I think 27. So pretty young, kind of a big goal of mine to do that.” Daniel

Daniel was another example; his parents taught him the practice of asset management and homeownership. Since his father instilled the importance of asset management, that influenced decisions in purchasing a home at 27. Essentially supporting the idea that family has a direct impact on Mexican Americans money management.

Familial Capital impact on educational success

In my findings, there was a prominent theme of family shaping participants academic success. My research showed that five out of seven participants completed some form of higher education while two out of seven did not. An example was demonstrated with the participant below:

“....We're not gonna be able to inherit you money or leave you anything but your education, nobody can take that away. So if you focus now you can do whatever you want and nobody will ever, take it away because your education is the only thing that is not money. You can lose physical things but education, you'll always have the letters behind your name’...Okay, I have to do really good in school because that's the only way that I'm gonna go to college and I'm gonna get a good job.’ So, in a way I always knew school was going to be my route to be successful one day.” -Ellie

This is an example of how family influences participants' perception of education. Ellie demonstrated how family shaped her journey in pursuing her education. Her family instills this value of education by establishing its importance and how this will be the only form of capital they’ll be able to pass on. Ellie established the motivation and importance of education cultivated by her family made her eager to complete higher education (education beyond high school). Ellie successfully pursued college because her family motivated her to complete her education. Mexican American’s utilize the family spaces to achieve success in social institutions like education. Mexican American’s convert their familial support into inspiration, economic opportunities, or emotional support; in Ellie’s case, inspiration.

Challenges:

Wealth Attainment-

Familial and economic obligations impacting wealth attainment

When analyzing my research, I found an interesting intersection between family, economic hardships, wealth attainment, and gender. Four out of seven participants felt familial obligations revolving around money that impacted their wealth attainment, and all four participants were female. Three out of seven participants that did not feel those familial obligations were male. My data presented that all female participants faced some form of delay in their wealth attainment due to their familial hardships revolving money. While their male counterparts did not face any delays in wealth attainment. I asked the question below to one of the female respondents:

Are there any hardships you face while obtaining your goals? [Like] financial or family responsibilities?

Yes, definitely. Our financial goals [as a family] have had a larger impact on me. [Then] my family responsibilities and then not having the knowledge sooner, I would have had more than what I have now.” Leliani

Leliani illustrated the impact that her family hardships had on her financial goals. Leliani had expanded her response with:

“I’ve took the [financial] responsibility to be supportive [because] they needed the help, so I offered the help… I help my parents when it comes to the household, so they don’t feel overwhelmed..” Leliani

Essentially establishing the importance of her family and her desire to take on the role of being financially responsible for her parents. She had not taken the role by force but by desire to help her family in their time in need. However, this financial role has delayed Leliani in obtaining assets. She has not had the opportunities to expand her assets [beyond a vehicle and credit] since she’s taken on this role.

I asked another female respondent, Lesli, a different question, yet her answer resembled Leliani’s response.

“I started helping my parents with a lot. I started taking on a lot of bills and responsibility. I was able to make my parents' plans come into fruition. I took a lot of financial responsibility. [For example], we were able to buy a second home and rent another one of our houses and [as a result] we moved into a bigger house, we bought a big property… I have a lot of financial responsibilities for somebody my age. I’m constantly like, ‘how can I invest my money to be smarter with it?’, if I’m obviously if I’m carrying my bills and (considering how) my dad’s is going to buying a second home and now I’m starting to save for my own home.”-Lesli

Lesli had not only taken on the role of being financially responsible for her family, but she also expanded her parents' assets. She also heavily considers her family financial goals when expanding her own assets. I found that participants desire to fulfill their family's financial responsibility only fell onto the female

respondents; while male respondents did not mention their families when obtaining their assets nor did they consider them when expanding them.

Education-

How familial and economic factors impacted participants academic opportunities

Another interesting finding that emerged from my research was the intersection between family, money, and academic opportunities. I found that participants familial hardships revolving around money were linked to participants academic opportunities. For example, if a participant had an opportunity to attend a prestigious school, their family's economic status heavily influenced their ability to attend. Based off my research, most of my participants had to reject offers and opportunities revolving around school because they could not afford it. Four out of seven participants were impacted by familial circumstances that revolved around money that delayed or impacted their educational opportunities.

Female respondent, Ellie, demonstrated that she had to turn down her ideal college due to her financial circumstance:

“I really wanted to go to Scripps. I told my Dad, ‘I promise I will get straight A’s, I’ll work while I go to school, just please pay that money so that I can go’. He had to sit me down and tell me, ‘we can’t afford that and there’s no way that we can pay that much money’… It just became too expensive and my dad was like, ‘I know, that’s like you want to go there and you worked so hard, and you’ve done all this stuff but Cal Poly is also a really good choice. Everything’s paid. You’ll even get money for your books and stuff. Why don’t you just focus on like, going there?’ And I was devastated because I worked my whole lifespan and I’ve always done everything right… I ended up going to Cal Poly.” -Ellie

Although Ellie had done well in school, she was economically held back from attending her ideal college and had compromise to academic aspirations by attending a local college. However, this hardship did not

hold her back from achieving her goal in accomplishing school. Another female respondent had a similar experience:

*“Since I was young, I wanted to be a lawyer. I was set on the fact that I wanted to be a lawyer, and I was always [working] towards that. When I realized what it would take financially, it was a [huge] debt. I saw it as that **dream has to die**. I cannot put that on my family, I couldn’t afford to not work for five years, I need[ed] to be able to do something where I can start generating money for my family as soon as possible. When I got my master’s, I got into USC as a master’s program for business. I was so excited but then I realized that it’s a \$90,000 program and I was like, ‘**okay, that dream gotta die**’... I compromised the program that I really wanted versus the one I could afford and that was going to CBU which is local and getting a different degree. So, I think financially I’ve been aware, and I’ve had to it’s geared a lot of my decisions in in my life, especially during my 20s”. -Lesli*

Lesli experienced a similar circumstance to Ellie, where she had to miss out on great educational opportunities due to their family’s financial circumstances. Both respondents show that college tuition is not affordable, making it circumstantially difficult for them and their families to support their decision to attend those schools. Thus, demonstrating the how social institutions like education make it structurally difficult for marginalized groups like Mexican Americans to attain higher education. As a result, they’ve built different skills and strategies to be involved in these social spaces, specifically education. In addition to that, respondents tend to be mindful of their family’s well-being when making these decisions, to ensure it will not place them in debt.

Discussion:

My data has shown that education, family, and financial literacy are intersecting factors that determines Mexican American’s success in wealth attainment as these factors often overlap with one another. I can even build the claim that these aspects are dependent on one another to be successful and increase the achievement of wealth attainment. However, the significance of this research is the following: to identify the contributing factors that shape financial spaces; how these spaces are discriminatory to the Mexican American Community; and how the Mexican American Community has created strategies to enter these spaces. My research has found that these conversations revolving money or assets are often found in family, education, and financial circles. Unfortunately, the obstacle of these spaces is that they are not always educational thus holding back the community from becoming financially literate. Therefore, my goal is to make these networks more financial literate to increase Mexican American’s access to wealth and social mobility. Therefore, I encourage all Mexican Americans to seek out educational resources to learn about the basics of financial literacy then apply it to real world experiences. This can look like: talking to a bank teller or a peer that is financially literate, watching a video on YouTube about increasing your assets, or signing up for a course at school. From there, pass down the knowledge as we shape the paths of future generations. Therefore, we must acknowledge that our skills are powerful and can taught to future generations of Mexican Americans.

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Community-driven leadership: Mexican-origin farmworking mothers resisting deficit practices by a school board in California Natalia Deeb-Sossaa and Rosa Manzo