UNC JOURNEY

Letter from the Editors

Dear Reader,

We are excited to present to you the sixth annual volume of JOURney, the University of North Carolina at Chapel Hill's first interdisciplinary Journal of Undergraduate Research!

JOURney started as an idea of founder Gabi Stein to create a journal that would showcase the outstanding, diverse range of student research done by the UNC Chapel Hill undergraduates. With the support of the Office of Undergraduate Research, JOURney became an official publication, allowing students a place to publish SURF projects, partial and full honors theses, and independent research.

This year, JOURney has continued to expand, gaining many successes along the way with the most number of submissions. With all the excellent work submitted, we are able to exhibit 16 original pieces of work here that explore interesting, topical, and complex areas of research. We congratulate the student authors on all their hard work put into researching and publishing their work!

We are so thankful to everyone who has helped JOURney continue to meet its mission of celebrating and supporting the research conducted early in students' academic careers. We would like to thank the Office for Undergraduate Research, which has provided JOURney unwavering support since its inception. We would also like to thank our entire editorial board and publicity team, who have spent many dedicated hours into making this edition. As the current CoEditor-In-Chiefs, we have enjoyed helping JOURney expand as an organization.

We leave you here to explore the work presented in this journal. We hope you will enjoy the knowledge collectively presented to you by the students of UNC Chapel Hill.

Sincerely
Vanya Bhat and Ricardo Tieghi
 2022-2023 JOURney Co-Editors-in-Chief

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Meet the author:

Vandanaa Jayaprakash is a junior majoring in Biology and Medical Anthropology with a minor in Neuroscience. Impelled by her desire to deliver affordable medications, she started her work in cancer research in the Pecot lab, choosing a challenging problem to tackle. Vandanaa aims to implement RNA interference therapeutics to slow down the activity of the KRAS enzyme in lung and ovarian cancers, which was previously deemed "undruggable". Her contributions to the project have already led to several promising candidate siRNAs that she was able to help discover as a Taylor Fellow in the Summer Undergraduate Research Fellowship. In addition to her project, Vandanaa has devoted time to serving those affected by cancer – especially in underreserved communities. She has helped lead the fundraising divisions for the UNC chapters of the Carolina Cancer Association and GlobeMed, raising donations for families impacted by cancer in NC and in Guatemala. She also volunteered in the nursing unit of the UNC Neuroscience Hospital in which she cared for diverse patients with neurological conditions, including brain tumors. As a proponent of equality in education, Vandanaa helped build the foundation for the STEM Academy of NC and is currently a mentor for elementary kids in underserved communities.

Characterization of Potent Fully Modified siRNAs That Preferentially Silence KRAS G13D Transcripts in Cancer Cells

Vandanaa Jayaprakash

The KRAS oncogene is implicated broadly in human cancer [1]. Remarkably, 31% of lung, 45% of colon and 98% of pancreatic cancers are driven by abnormal KRAS activity. In the cell, KRAS is a GTPase protein in the MAP kinase pathway that directs cell survival and proliferation [2]. G12D, G12C, G12V and G13D missense mutations lock the protein in a GTP-bound active state, overstimulating MAPK effectors and leading to uncontrollable cell division [3]. Despite its wide prevalence in cancer, KRAS is often termed "undruggable" for its difficulty in accessing its active site. The large affinity of GTP to KRAS and the absence of accessible hydrophobic pockets makes molecular inhibitors challenging to design [1,4].

In 2019, an inhibitor against the G12C KRAS mutant demonstrated a decrease in lung tumorigenesis by securing the protein in its inactive GDP bound state. The treatment, however, was only effective for 11% of KRAS derived cancers [5]. Thus, cancer therapy needs versatile molecules that can target oncogenic KRAS while sparing the wildtype form; RNA interference (RNAi) has the unique potential to genetically target KRAS, potentially solving this problem. RNAi mechanisms transport synthetic oligonucleotides into cells to degrade the mRNA of a gene of interest. RNAi has shown immense potential as a therapeutic agent in many disorders, including HIV and Huntington's disease, for its specificity [6].

(One such oligonucleotide, siRNA, interacts with the RNA-induced silencing complex (RISC) to cleave mRNA, resulting in a less functional gene product [7]. This type of inhibition is especially valuable when aiming to target proteins that are difficult to silence by small molecules, such as KRAS. Rapidly entering the clinic, siRNA technology has become a promising alternative, as evidenced by several FDA-approved drugs, like givosiran [8].

The Pecot lab has constructed fully modified siRNAs that can knock down KRAS and kill human cancer cells in vitro, but the sequences can only partially spare the wildtype [9]. As a result, the Pecot lab in conjuction with a company called AXO labs have designed 15 siRNAs with different unique combinations of chemical and sequence modifications that are predicted to increase its specificity to silence the KRAS G13D mutant, which is a top source of lung and colon cancers, over the wildtype transcript. The focus of this project is to identify the most potent combination of modifications in KRAS G13D specific siRNA that effectively decreases abnormal KRAS activity and slows tumorigenesis.
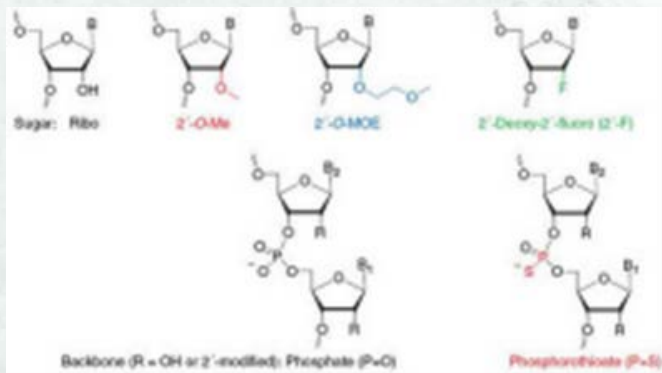
Figure 2. Structures of chemical modifications for siRNAs.
Combination of modifications in the sugar and backbone of siRNA that are necessary to develop compounds with optimal activity [10].

METHODS:

To identify the siRNA design with the highest affinity for mutant KRAS mRNA, the 15 candidates were transfected into mutant G13D and wildtype cells of the A431 cell line. Following delivery of the siRNA to each cell line at 20 nM, the KRAS RNA was isolated from both cell types after a 48 hr transfection period. The isolated RNA was then converted to cDNA and quantified via RT-qPXR. The KRAS mRNA levels were normalized against the 18S gene as a standard. The data generated indicated that 4 of the siRNA sequences out of the 15 candidates were the most potent and sparing of the wild type compared to the controls. In order to further characterize the potency among the top candidates, the selected siRNAs were again transfected into A431 G13D mutant and wild type cells but at a lower dose of 10 nM to potentially increase the competition in the system, leading to more preferential mutant targeting. The optimal concentration and transfection time were found to be 20 nM and a 48 hour period, respectively, after analysis of readouts comparing relative KRAS mRNA levels between the two cell types among the top 4 candidates.

Treatment with an optimal dose of the most discriminatory siRNAs is expected to knockdown dysfunctional KRAS and decrease downstream effector activity. To quantify the attenuation of this MAP kinase signaling, western blots were performed to measure any decrease in mutant KRAS levels. After G13D mutant and wild type cells were transfected with the best 2 siRNA sequences among the top 4 candidates at 20 nM for 48 hours, KRAS protein was isolated from both cell types via lysis. Next, the samples were subjected to an SDS-PAGE with electrotransfer for approximately 1.5 hours with the voltage increasing from 60V-100V. After this, protein specific antibodies probed for both KRAS and Vinculin protein as a standard. Readouts for the intensities of the bands between mutant and wild type samples were compared against the controls. A BCA standard curve was also conducted to measure the relative protein levels of KRAS between the wild type and mutant cells after transfection with the lead siRNAs under optimal conditions.

RESULTS:

Figure 3. Normalized KRAS mRNA in mutant and wild type A431 G13D cell lines after
transfection with different siRNAS at 10 nM for a 48 hour period. The wild type mRNA is in blue and the mutant levels are in orange. The KRAS G13D 2'OMe is the negative control, Seq2 DV22 is the positive control (no wild type sparing) and the G13D Hi2F is a modified control. Transfection of the 15 different siRNAS shows that EFTX 6,7,8 and 10 demonstrate the greatest knockout efficiency of mutant KRAS mRNA, while sparing the wild type counterpart.
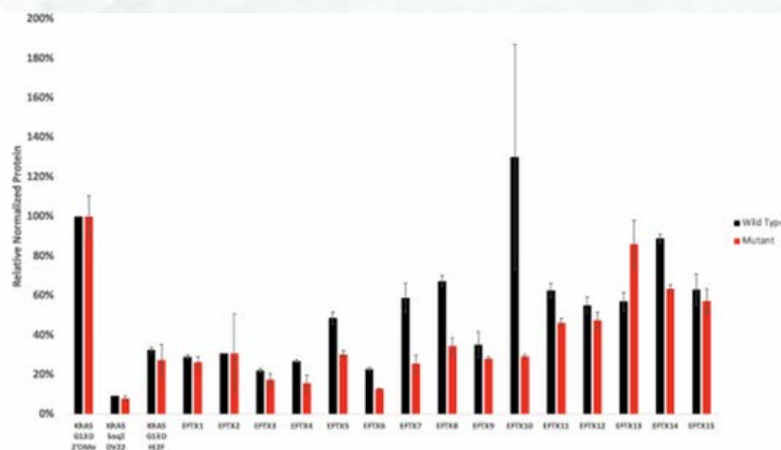
Figure 4. Normalized KRAS mRNA in mutant and wild type A431 G13D cell lines after transfection with EFTX 6,7,8 and 10 siRNAS at 20 nM for a 48 hour period. The wild type mRNA is in black and the mutant levels are in red. The KRAS G13D 2'OMe is the negative control, Seq2 DV22 is the positive control (no wild type sparing) and the G13D DV22 is a positive control (with wild type sparing). Transfection of the top 4 siRNAS shows that EFTX 7 and 10 have the greatest knockout efficiency of mutant KRAS mRNA, while sparing the wild type sequence.

b) **Figure 5.** a) Western blot of KRAS protein levels after transfection with EFTX 7, EFTX 10 and
controls at 20 nM for 48 hours compared against the vinculin standard protein. The KRAS protein is located around 22 kDa, while the vinculin standard is around 117 kDa. b) Relative normalized KRAS protein levels from the same transfection as in panel a to confirm wild type sparing of functional KRAS and partial knockdown of the mutant.

DISCUSSION

The G13D mutation in the KRAS oncogene is a well-established driver of cancer, especially in lung and colon cancer [1]. This study describes a novel approach in silencing the G13D mutation using RNAi interference. Unique combinations of chemical and nucleotide modifications were added to a potent siRNA parent molecule in order to increase its specificity to the mutant KRAS mRNA while sparing the wildtype sequence. In this way, direct mutant specific inhibition is achieved and it circumvents problems associated with the difficulty in accessing KRAS's active site, its large affinity for GTP and its absence of accessible hydrophobic pockets for small molecule inhibitors [9].

After transfection of the 15 different siRNAs in the mutant and wild type A431 cells at a 10 nM dose for 48 hours, EFTX 6,7,8 and 10 demonstrated the greatest knockdown in mutant KRAS mRNA while sparing the wild type counterpart compared to the controls (Figure 3). The KRAS G13D 2'OMe is a negative control in which the siRNA has been modified with methyl groups attached to the 2' oxygen so it is not specific to either the wild type or the mutant mRNA but is thermodynamically stable in the cell. It also prevents the siRNA from loading onto the RISC complex. The KRAS Seq2 DV22 siRNA is a positive control that binds with exactly the same affinity to both the wild type and mutant strands. The KRAS G13D DV22 siRNA is another positive control with wild type sparing and it is also the parent molecule siRNA to which modifications have been added to increase its specificity to the mutant sequence.
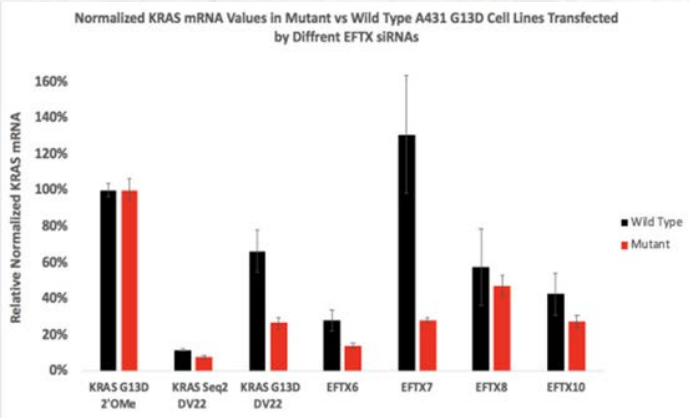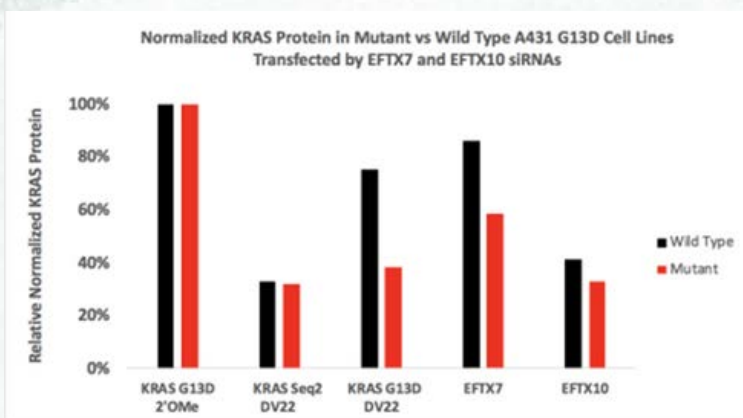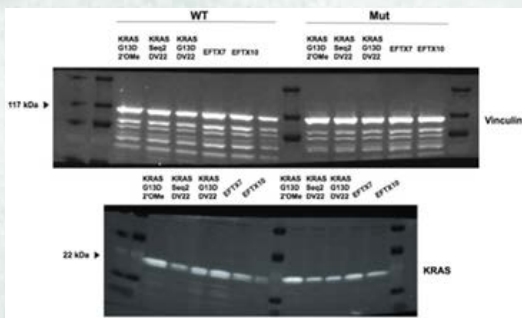
After the four lead siRNAs were transfected in the two cell types again but at a higher dose of 20 nM for 48 hours, the EFTX 7 and 10 sequences showed the greatest specificity to the mutant mRNA over that for the functional KRAS and had knockdown levels similar to that of the G13D DV22 parent molecule (Figure 4). This suggests that the combination of chemical and nucleotide modifications present on the EFTX 7 and EFTX 10 siRNAs may increase specificity to the G13D mutant KRAS mRNA, improving wild type sparing and knockdown efficiency, while maintaining stability within the cells.

The effects of mutant KRAS knockdown can also be observed at the translational level as demonstrated by the western blot data. Transfection of EFTX 7 and EFTX 10 at 20 nM for 48 hours and isolation and quantification of the relative normalized KRAS protein levels confirms wild type sparing of functional KRAS and partial knockdown of the mutant as indicated by the fainter bands in the mutant samples of the western blot and lower levels of mutant in the quantification plot (Figure 5 a,b). This data reinforces that EFTX 7 and EFTX 10 have mutant specific inhibition in the cells by preferentially binding to the G13D mutant KRAS mRNA, causing it to become degraded before it can be translated into protein. Degradation of the mutant effectively leads to the silencing of the mutated KRAS gene in the cancer cells, which are dependent on KRAS to survive.

Looking forward, it is of importance to test whether the incorporation of the unique modifications from EFTX 7 and EFTX 10 onto the KRAS G13D DV22 parent molecule siRNA will further improve knockdown and mutant specificity. Once potency and wild type sparing are confirmed at the translational level, western blot analysis of the phosphorylation of the downstream effector ERK1/2 will assess oncogenic MAPK pathway activity. The viability of cancer cells harboring the KRAS G13D mutation will be determined after siRNA transfection in HCT116 (colorectal) and H1944 (lung) cell lines cultured in 96-well plates, and total metabolic activity of cells will be evaluated with Cell Titer Glo at defined time points after siRNA transfection. Next, the same analysis will be conducted through a 3D spheroid assay in which the cells will grow in a tumor-like environment in which the tumorgenicity of the G13D mutants can be tracked. By elucidating the most potent modifications, novel siRNA drugs that preferentially silence mutant KRAS can be developed, revolutionizing cancer therapy.

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Meet the author:

Rachel Anonick is a senior majoring in Psychology and Human Development and Family Science with plans to pursue a doctorate in Clinical Psychology. Her research interests include the role of protective factors on adolescent mental health and examining therapeutic techniques and processes for depression and anxiety in adolescents and young adult populations. Throughout Rachel's career at Carolina, she has worked as a research assistant in Dr. Marisa Marraccini's lab, which is focused on developing a mixed-reality intervention for adolescents hospitalized with suicidal experiences. Additionally, she has recently completed a research internship with Dr. Dorothy Espelage, whose research spans all topics of children and adolescent mental health, focusing on social-emotional learning, prevention science, and school-based mental health interventions. These two in-depth experiences led to choose Psychology 528: Clinical Research with Dr. Desiree Griffin to gain further experience with psychology's research and writing process. This CURE course challenged Rachel and her groupmates to create a research project that reflects young adolescents' mental health and belonging in school. Additional information
about the team can be found here: https://teamjordanpsych.weebly.com/get-in-touch.html

The Moderating Roles of Race and Ethnicity: Examining the Effects on Student-Teacher Relationships, Cultural Pluralism, and Sense of Belonging

Rachel Anonick, Estefania Ledesma, Lizzie McIntosh, Hattie Parsley, Madison White, and Sundeep Kaur

Abstract

Students' experiences in schools are shaped by the environment the school creates, and therefore fostering strong student-teacher relationships and providing space for culturalism may lead to better student outcomes, including an increased sense of belonging. This study examines the role of race and ethnicity in the relationship between cultural pluralism, student-teacher relationships, and a sense of belonging. We hypothesized that race and ethnicity will moderate the relationship between cultural pluralism and sense of belonging as well as student-teacher relationships and student belonging. Data were drawn from the publicly available School Safety and School-Based Mental Health Services database, which surveyed middle-school students' reports of cultural pluralism, student-teacher relationships, and sense of belonging. Cultural pluralism and student-teacher relationships were positively associated with a sense of belonging among all middle-school students. In contrast to our hypothesis, White students experienced more significant increases in their sense of belonging as cultural pluralism increased compared to Black students. These findings suggest that racial minority populations in schools may benefit from increased cultural pluralism, including schools where White students may be the minority population.

Key Words: Cultural pluralism, school, belonging, relationships, minority students

Supportive school environments are crucial to a student's academic success and emotional health. School environments are shaped by the relationships created through daily interactions with teachers, staff, and peers. These relationships subsequently contribute to students' sense of belonging in their school environment. Central to a high sense of belonging is perceived levels of acceptance, respect, and acknowledgment from peers and teachers. Providing a supportive school environment where students feel accepted and heard may be accomplished by promoting cultural pluralism, which is where different cultural backgrounds are embraced, and individuals are encouraged to maintain their own unique cultural identity within a larger setting (Oczlon et al., 2021). Research shows that high levels of cultural pluralism are crucial for minority students to feel open and accepted enough to express their cultural identities in school (Oczlon et al., 2021). However, there is limited research on cultural pluralism and its impact on students' emotional health, sense of belonging, academic outcomes, and more.

Students interact with teachers for a significant portion of their lives, which furthers the importance of these relationships. Unfortunately, research has shown that teachers can have biases that ultimately impact minorities negatively, specifically African American children (Stark et al., 2020). In addition, Latino/a students have difficulties feeling welcome and accepted by school teachers (Marx, 2008; McClain, 2019). While it is known that these biases can harm relationships with students, little research has explored how these biases may affect students' sense of belonging. The current study examines how cultural pluralism and student-teacher relationships impact student sense of belonging and how race and ethnicity might moderate these relationships. Hopefully, this research informs future school initiatives that better target specific cultural and social belonging inadequacies within schools for students of all backgrounds.

Cultural Pluralism

Cultural pluralism promotes valuing differences between cultural groups and fosters knowledge and respect for different customs and traditions. Within educational settings, cultural pluralism practices look like teachers implementing lessons on multicultural topics and intercultural relations or taking an active interest in others' cultures. Cultural pluralism promotes psychological school adjustment by supporting well-being and life satisfaction among immigrant students and contributing to feelings of acceptance and value in academic settings leading to greater self-esteem, academic self-concept, and achievement (Oczlon et al., 2021).

Research highlights how perceived discrimination is one of the major challenges ethnic minorities face that can negatively impact their academic outcomes and psychological well-being (Schachner et al., 2019). Significant belonging and achievement gaps between majority and immigrant minority groups persist within schools, negatively impacting the psychological development and future life chances of minority students (Celeste et al., 2019). In most countries, there is evidence that minority students have fewer positive perceptions of their school climates, leading to more negative academic outcomes, partly due to discrimination (Schachner et al., 2019). Previous literature shows that prejudice and discrimination stemming from race and ethnicity may decrease feelings of belonging for some students (Bottiani et al., 2017; Faircloth & Hamm, 2005; Murphy & Zirkel, 2015).

Endorsing cultural pluralism empowers minority students to feel valued, resulting in better academic performance compared to approaches that threaten their identity. Research demonstrates the positive effects of an inclusive multiculturalism (or cultural pluralism) approach within schools. This approach saw higher belonging among students, which led to greater achievement, self-concept, and life satisfaction (Celeste et al., 2019; Byrd, 2015; Oczlon et al., 2021; Schachner et al., 2019). Immigrants' positive self-beliefs, including self-esteem and self-concept, benefited in a cultural pluralism climate. As a result, higher levels of achievement were present for immigrants when cultural pluralism was also present (Oczlon et al., 2021). Additionally, research shows that teachers' support for diversity can impact student outcomes, highlighting the possibility that cultural pluralism and student-teacher relationships impact students' sense of belonging (Oczlon et al., 2021).

Some studies suggest that support for cultural pluralism within schools may have a greater effect on outcomes for students of minority racial and ethnic backgrounds than majority racial and ethnic populations (Brand et al., 2003; Celeste et al., 2019). Brand and colleagues (2003) found that in schools with higher levels of support for cultural pluralism, minority students showed significantly higher levels of belonging in comparison to White students; however, another study found no significant differences in the effects of the cultural diversity climate on student belonging between immigrant and nonimmigrant students (Schachner et al., 2019). Conflicting literature suggests a need for additional research on how cultural pluralism impacts student outcomes differently depending on their membership in the minority or majority population.

The effect of cultural pluralism in school environments is a relatively new area of research. Currently, minimal literature exists regarding how perceived cultural pluralism may predict students' sense of belonging, especially in the context of a middle school environment. The few studies that have examined this relationship focus specifically on immigrant students and are largely conducted in countries outside of the United States (Ozclon, 2021; Schachner, 2019). Given that the United States is a diverse nation, such research is important in understanding how to foster a better sense of belonging among all students.

Student-Teacher Relationships

Teachers' involvement is central to children's experience in a classroom setting (Allen et al., 2021; Skinner, 1993). Teachers play a crucial aspect in providing an environment in which students can feel comfortable and secure; to go on to develop a sense of belonging. Teachers accomplish this by creating a fair environment, good rapport, more availability, a warm presence, and support for the student. Through these components, the student will feel cared for, respected, valued, and accepted (Allen et al., 2021).

Substantial research shows that positive student-teacher relationships positively correlate with a sense of belonging in students (Allen et al., 2021; Ibrahim & El Zataari, 2020; Scales et al., 2020; Visser & Arends, 2019), motivation (Ellen & Belmont, 1993; Scales et al., 2020; Visser & Arends, 2019), and academic outcomes (Allen et al., 2021; Tillman-Young, 2018; Visser & Arends, 2019). Through support, teachers can nurture a student's academic career and help them thrive in school.

However, challenges include developing student-teacher relationships with students of color and ethnicity due to a lack of cultural acceptance (Bjorklund, 2019; Boston & Warren, 2017; Tillman-Young, 2018). In a study looking at 20 Black immigrant students in New York, Kumi-Yeboah and colleagues (2021) found that students felt isolated and discriminated against by their teachers and peers because of the teachers' and peers' lack of cultural awareness and interest. In addition, the majority of the 25 teachers in the study admitted lacking cultural knowledge and experience with teaching Black immigrant students, making it hard to acknowledge and recognize the students' culture. Similar results were also demonstrated in another study, which showed that most White teachers in a school lacked knowledge of African American culture and cultural training (McClain, 2019). Hispanic/Latino students also struggle to develop relationships with their teachers, as evidenced by Hispanic/Latino students and their families not feeling welcome in a predominately White school (Marx, 2008). In addition, Hispanic/Latino students felt their White teachers did not appreciate their culture and language compared to the White students in the school (Bjorklund, 2019). From these studies, students of color and ethnicity could not develop a close relationship with their teachers because teachers lacked cultural awareness; hence, students might not have felt respected and accepted.

For students to establish positive and strong relationships with their teachers, there must be mutual acknowledgment between them; thus, if one lacks interest in the other, the relationship will fall apart or not be substantial (Allen et al., 2021; McClain, 2019). Furthermore, the show of interest must be genuine and authentic (McClain, 2019). Teachers must understand and appreciate the culture of students of different racial and ethnic backgrounds to establish genuine relationships. As a result, all students can benefit from the social and academic advantages of an increased sense of belonging in schools resulting from student-teacher relationships.

Although previous literature established a predictive relationship between student-teacher relations and student sense of belonging, there is a lack of research on how race and ethnicity may moderate this relationship. Most literature surrounding student-teacher relationships and a sense of belonging has focused on homogeneous populations or has overlooked the differences between racial and ethnic groups altogether (Ibrahim et al., 2020). Our study hopes to contribute to past research by examining race and ethnicity as moderating variables.

Sense of Belonging

Sense of belonging refers to the feelings of security and support that can come from many outlets, such as family, friends, and teachers. School-aged children's sense of belonging greatly impacts their academic outcomes, such that higher levels of sense of belonging have been linked to greater achievement and achievement motivation (Faircloth & Hamm, 2005; Neel & Fulgini, 2013). A student's sense of belonging in school relies on their perception of their school surroundings and relationships, which can be impacted by their race, ethnicity, and majority/minority status within the school (Duran, 2020: Murphy & Zirkel, 2015; Faircloth & Hamm, 2005). For example, one study found that among middle school students, African-American students self-reported that belonging predicts their educational efficacy, but this same effect was not found with White students (Murphy & Zirkel, 2015). A different observational study examining the Black-White discipline gap (Bottiani et al., 2017) showcased that school-level discipline gaps were associated with Black students' perceptions of less school equity, less school belonging, and greater adjustment problems, while significant associations were not found for White students. These studies highlight the important role ethnic and racial group membership contributes to a student's sense of belonging and the potential barriers a student might experience if they hold a minority status within the school. Therefore, it's important to understand better the complex relationship of variables that contribute to one's sense of belonging.

Hypotheses

This study seeks to understand how student-teacher relationships and cultural pluralism are associated with sense of belonging among middle school-aged students. Cultural pluralism is known to help promote psychological school adjustment and contribute to feelings of being accepted and valued in academic settings (Oczlon et al., 2021). The first hypothesis was that cultural pluralism would be positively associated with sense of belonging. Next, substantial research has shown that positive student-teacher relationships correlate positively with students' sense of belonging, such that positive relationships predict higher belonging (Allen et al., 2021; Ibrahim & El Zataari, 2020; Scales et al., 2020; Visser & Arends, 2019). As a result, wehypothesized that student-teacher relationships would be positively associated with sense of belonging among middle school students.

This study explores how race and ethnicity moderates the relationship between cultural pluralism and sense of belonging, and student-teacher relationships and sense of belonging among middle school students. These relationships were explored in four separate analyses, as shown in Figure 1. Prior research has shown that Black immigrant students may feel isolated and discriminated against by their teachers due to a lack of cultural awareness and interest (Kumi-Yeboah et al., 2021). This finding lead to the hypothesis that when student-teacher relationships are rated highly, there would be a larger increase in sense of belonging among Black students in comparison to White students. Consistent with this, there is evidence that low multiculturalism in school environments is associated with a lesser sense of belonging for minority students (Brand et al., 2003; Celeste et al., 2019). This study predicted that students who identify as Black or African American would display larger increases in sense of belonging when cultural pluralism is high in comparison to White students.

In addition, Hispanic or Latino/a students often struggle to develop relationships with teachers and to feel welcome within a school setting (Marx, 2008). Thus, we predicted that Latino/a middle-school students would have greater increases in sense of belonging when cultural pluralism and student-teacher relationships are rated highly, compared to non-Hispanic students. Congruently, research suggests that support for cultural pluralism may have a lesser impact on outcomes for students of majority backgrounds in comparison to minority students (Brand et al., 2003; Celeste et al., 2019). With this, we hypothesized that White and non-Hispanic students would be less affected by their school's environment of cultural pluralism and student-teacher relationships.

Figure 1. Hypothesis Model
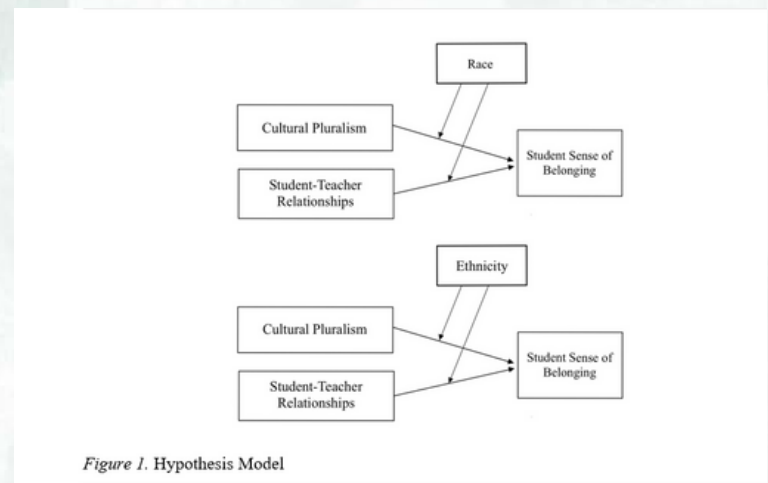
Methods

The data used in this study is from the School Safety and School-Based Mental Health Services in a Large Metropolitan School District project conducted by researchers at Research Triangle Institute (RTI) International (Morgan-Lopez et al., 2020). Although the dataset is on a publicly accessible platform, we obtained the dataset from one of the study's original authors (Morgan-Lopez et al., 2020). The original study sought to analyze the effectiveness of school-based mental health (SBMH) services in improving school safety and well-being for middle school students. Survey data was collected from 34 middle and K-8 schools within the public educational system of Charlotte-Mecklenburg County, North Carolina. The SBMH Student Survey was randomly distributed to students in grades 6, 7, and 8. This anonymous paper-and-pencil survey was distributed to participants based on the random selection of six to nine classes that are common to all students (e.g., health and physical education). Three waves of data were collected: Fall 2016 (Wave 1 - baseline), Spring 2017, and Spring 2018. Our current study uses data from Wave 1 as it provides a baseline from which we explored race and ethnicity as moderators in the relationship between student-teacher relationships, cultural pluralism, and sense of belonging before any treatments were implemented in the original SBMH study.

Participants The Fall 2016 wave had 4,021 student respondents who were an average age of 12.3 years old and 50.1% identified as male. The racial makeup of the sample included 25.7% White, 50.3% Black or African American, 7.5% who selected no race, and 16.5% who selected another race such as Asian, American Indian or Alaska Native, or Native Hawaiian.

These two racial groups were not included in analyses as the current study only examined White and Black racial groups. The ethnic makeup of participants was 35.9% Hispanic, as the survey separated ethnicity from racial identity. Out of the 4,021 students, 34.5% were sixth graders, 30.5% were seventh graders, and 34.9% were eighth graders. For the purposes of our analyses, we excluded participants with nonresponses to questions regarding student-teacher relationships, support for cultural pluralism, and student sense of belonging, which reduced our respondent pool to 2,805. After excluding participants, the remaining respondent pool was not significantly different in racial or ethnic demographics compared to the original pool of respondents described above.
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Measures

Support for Cultural Pluralism Subscale. The Support for Cultural Pluralism Subscale (Brand et al., 2003) measures student perceptions of the school's support for and promotion of cultural pluralism and diversity. The subscale is composed of four, 5-point Likert-scale (1 = Never and 5 = Always) questions, measuring the frequency of certain student experiences in school. Example items include "Your teachers show that they think it is important for students of different races and cultures at your school to get along with each other," and "Students of many different races and cultures are chosen to participate in important school activities" (Brand et al., 2003). The subscale had a Cronbach's alpha of .68 (Brand et al., 2003).

Teacher Support Subscale. The Teacher Support Subscale (Brand et al., 2003) measures student perceptions of the commitment to and support of students relayed by teachers. The subscale is composed of four items that are answered with responses ranging from 1 to 5, where 1 = Never and 5 = Always, measuring the frequency of events that convey teacher support in school. Examples of items from the subscale include "Teachers go out of their way to help students" and "If students want to talk about something, teachers will find time to do it" (Brand et al., 2003). The subscale had a Cronbach's alpha of .76 (Brand et al., 2003).

Psychological Sense of School Membership. The measure of students' sense of belonging that will be used within this study is the Psychological Sense of School Membership subscale (Goodenow, 1993). The 18- item 5-point Likert scale (1 = Not at all true and 5 = Completely true) asks students about their perceived belonging. Example items include "I feel like a part of my school" and "People at my school notice when I am good at something" (Goodenow, 1993). The subscale had a Cronbach's alpha of .88 (Goodenow, 1993).

Race. Race will be operationalized as students identifying as White and Black or African American because these two racial groups constituted the majority of respondents. The populations of other minority groups are not large enough to yield statistical power. Students were asked, "What race do you consider yourself to be?" Respondents were allowed to select from more than one race. The options were American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, and White.

Ethnicity. Ethnicity will be operationalized as students identifying as Hispanic/Latino/a or non-Hispanic/Latino/a. Students were asked, "Do you consider yourself to be Hispanic or Latino/Latina?"

Results

Mean Scores on Teacher Support, Cultural Pluralism, and Sense of Belonging

When comparing results among all participants, results showed that the mean level of student-teacher relationships was 3.31 on a scale ranging from 1 to 5. For the support for cultural pluralism scale, the mean value was 3.65, and for sense of belonging, the mean was 3.18, both on a scale ranging from 1 to 5. See Table 1 for differences in means between White and Black students, and see Table 2 for differences between Hispanic and non-Hispanic students.

	White Students M (SD)	Black Students M (SD)
Student-Teacher Relationships	3.34 (.73)	3.28 (.50)
Cultural Pluralism	3.72 (.84)	3.62 (.91)
Sense of Belonging	3.22 (.50)	3.21 (.50)

Table 1. Descriptives on student-teacher relationships, cultural pluralism and sense of belonging on White and Black students. The table shows mean scores (M) and standard deviation values (SD).

	Hispanic Students M (SD)	Non-Hispanic Students M (SD)
Student-Teacher Relationships	3.36 (.68)	3.28 (.70)
Cultural Pluralism	3.68 (.86)	3.65 (.90)
Sense of Belonging	3.11 (.50)	3.23 (.49)

Table 2. Descriptives on student-teacher relationships, cultural pluralism and sense of belonging on Hispanic and non-Hispanic students. The table shows mean scores (M) and standard deviation values (SD).

Correlations Between Cultural Pluralism, Sense Of Belonging, and Student-Teacher

Relationships

There were significant positive relationships between sense of belonging and cultural pluralism, $r(2300) = .41$, $p < .001$; sense of belonging and student-teacher relationships, $r(2161) = .48$, $p < .001$; and student-teacher relationships and cultural pluralism, $r(2648) = .49$, $p < .001$.

Linear Regression on Student-Teacher Relationships on Sense of Belonging

We hypothesized that positive student-teacher relationships would be associated with increased sense of belonging among middle school students, and we ran a linear regression of teacher support on sense of belonging. For those with an average amount of teacher support, we expect the sense of belonging subscale score to be 3.18 points (SE = .01, $p < .001$, $R^2 = .23$). For every one unit increase in teacher support, we expect sense of belonging to increase by .34 points (SE = .01, $p < .001$).

Linear Regression on Cultural Pluralism on Sense of Belonging

We hypothesized that greater endorsement of cultural pluralism would be associated with an increased sense of belonging among middle school students, and we ran a linear regression of cultural pluralism on sense of belonging. For those with an average amount of cultural pluralism, we expect the value on the sense of belonging subscale score to be 3.19 points (SE = .01, $p < .001$, $R^2 = .17$). For every one unit increase in cultural pluralism, we expect the value of the sense of belonging subscale score to increase by .23 points (SE = .01, $p < .001$).

Linear Regression on Student-Teacher Relationships on Sense of Belonging Moderated by Race

We used linear regression to test the hypothesis that race moderates how student-teacher relationships predict the outcome variable sense of belonging. It was hypothesized that Black students would experience a more significant increase in sense of belonging when teacher support was high. The expected value of sense of belonging for a White student with an average level of teacher support is 1.97 points (SE = .08, $p < .001$, $R^2 = .24$). For every one unit increase in the teacher support subscale, we expect the sense of belonging of a White student to increase by .37 points (SE = .02, $p < .001$). Thus, greater teacher support significantly predicted an increase in sense of belonging in White students. When the student is Black or African American, controlling for teacher support, we expect the sense of belonging subscale score to be .18 points higher compared to White students (SE = .11, $p = .09$). Black or African American students appeared to have a greater sense of belonging compared to their White peers, but this difference was not significant. The effect of teacher support on sense of belonging is not significantly moderated by race ($b = -.05$, SE = .03, $p = .13$). See Figure 3.

Linear Regression on Cultural Pluralism on Sense of Belonging Moderated by Race

We ran a linear regression to test the hypothesis that race moderates how the endorsement of cultural pluralism predicts the outcome variable sense of belonging. It was hypothesized that Black students would experience a greater increase in their sense of belonging when endorsement of cultural pluralism was high. The expected value of sense of belonging for a White student with an average level of endorsement of cultural pluralism is 2.22 points (SE = .08, p <.001, R^2 = .16). For every one unit increase in cultural pluralism, we expect sense of belonging of a White student to increase by .27 points (SE = .02, p < .001). Thus, greater endorsement of cultural pluralism significantly predicted an increase in sense of belonging for White students. When the student is Black or African American, controlling for cultural pluralism, we expect the sense of belonging subscale score to be .24 points higher compared to White students (SE = .10, p = .02). Black or African American students significantly had a greater sense of belonging compared to their White peers. The effect of endorsement of cultural pluralism on sense of belonging is significantly moderated by race (b = -.06, SE = .03, p = .03). When students identify as White, the effect of cultural pluralism is an increase of .27 points in sense of belonging (SE = .02, p < .001). When students identify as Black, the effect of cultural pluralism is an increase of .21 points in sense of belonging (SE = .02, p < .001). Greater endorsement of cultural pluralism significantly predicted an increase in sense of belonging, with a stronger predictive relationship among White students compared to Black, seen in Figures 2 and 3.
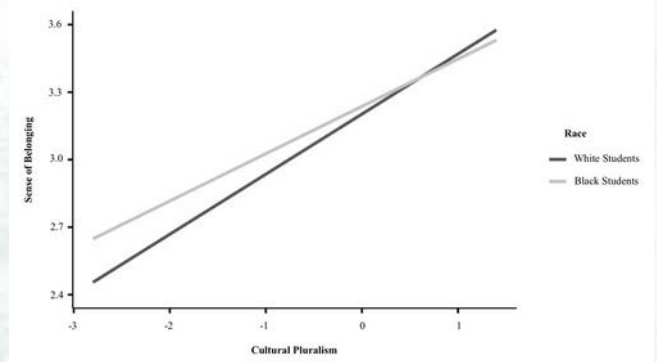
Linear Regression on Student-Teacher Relationships on Sense of Belonging Moderated by Ethnicity

We hypothesized that Hispanic students would experience a greater increase in sense of belonging when teacher support was high. The expected value of sense of belonging for a non-Hispanic student with an average level of teacher support is 2.03 points (SE = .06, p <.001, R^2 = .25). For every one unit increase in the teacher support subscale score, we expect the sense of belonging subscale score of a non-Hispanic student to increase by .36 points (SE = .02, p < .001). Thus, greater teacher support significantly predicted an increase in sense of belonging for non-Hispanic students. When the student is Hispanic or Latino, controlling for teacher support, we expect the sense of belonging subscale score to be .01 points lower compared to non-Hispanic students (SE = .10, p = .95). The effect of teacher support on sense of belonging is not significantly moderated by ethnicity (b = -.04, SE = .03, p = .14). See Figure 3.

Linear Regression on Cultural Pluralism on Sense of Belonging Moderated by Ethnicity

We used a linear regression to test the hypothesis that ethnicity moderates how cultural pluralism predicts the outcome variable sense of belonging. It was hypothesized that Hispanic students would experience a greater increase in sense of belonging when cultural pluralism was high. The expected value of sense of belonging for a non-Hispanic student with an average level of cultural pluralism is 2.43 points (SE = .05, p <.001, R^2 = .18). For every one unit increase in the cultural pluralism subscale score, we expect the sense of belonging subscale score of a non-Hispanic student to increase by .22 points (SE = .01, p < .001). Thus, greater cultural pluralism significantly predicted an increase in sense of belonging for non-Hispanic students. When the student is Hispanic or Latino, controlling for cultural pluralism, we expect the sense of belonging subscale score to be .25 points less compared to non-Hispanic students (SE = .09, p = .004). Hispanic or Latino students appeared to have a significantly lesser sense of belonging compared to their non-Hispanic peers. The effect of cultural pluralism on sense of belonging is not significantly moderated by ethnicity (b = .03, SE = .02, p = .15). See Figure 3.

Note: *p < .05
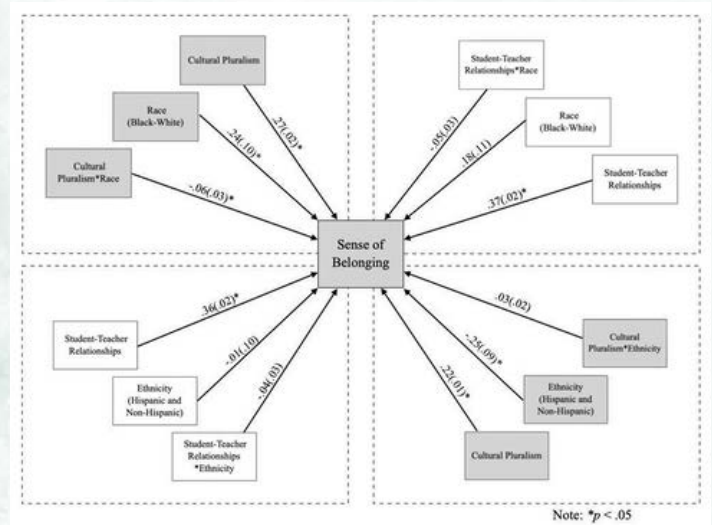
Figure 3. The model shows four separately run linear regressions, indicated by the dotted boxes. The four linear regressions are (1) the moderating effects of race on the relationship between cultural pluralism and sense of belonging, (2) the moderating effects of ethnicity on the relationship between cultural pluralism and sense of belonging, (3) the moderating effects of race on the relationship between student-teacher relationships and sense of belonging, and (4) the moderating effects of ethnicity on the relationship between student-teacher relationships and sense of belonging. For each variable, the figure provides the unstandardized regression coefficients (b), the standard error values (SE) in parentheses, and significance (p<.05) denoted by an asterisk, respectively.

Discussion

The current study sought to understand how student-teacher relationships and cultural pluralism are associated with sense of belonging outcomes among middle school-aged students. Additionally, this study explored the potential moderating effect of race and ethnicity on the relationships between cultural pluralism and sense of belonging and student-teacher relationships and sense of belonging. In line with our hypotheses, both cultural pluralism and student-teacher relationships were positively associated with sense of belonging outcomes in middle schoolers. These findings build upon existing evidence that teacher support and cultural pluralism contribute to feelings of acceptance and inclusiveness in academic settings (Ibrahim & El Zataari, 2020; Oczlon et al., 2021).

We further hypothesized that when cultural pluralism is high, Black students will demonstrate a larger increase in sense of belonging than their White peers. While we found that race moderates the relationship between cultural pluralism and sense of belonging, results surprisingly indicated that White students displayed a larger increase in sense of belonging in comparison to Black students. Regarding teacher support, we predicted that Black students would display larger increases in sense of belonging when teacher support is high compared to White students. Contrary to our hypothesis, race did not moderate the association between student-teacher

relationships and sense of belonging. This finding is inconsistent with existing literature, which suggests that Black students would benefit from high teacher support significantly more than their White peers (Bjorklund, 2019; Boston & Warren, 2017). We explore potential explanations for this inconsistent finding below, but it is still important to note that little research has been conducted exploring race as a moderator in this relationship. Our contrasting findings thus add to the existing literature and emphasizes the need for further research to explore these differences.

Previous research has also suggested that Hispanic students may struggle to develop relationships with teachers and to feel welcome within a school setting (Marx, 2008). Thus, we predicted that Hispanic middle-schoolers would demonstrate a greater increase in their sense of belonging when cultural pluralism and student-teacher relationships are rated highly, compared to their non-Hispanic peers. In contrast with our hypotheses, ethnicity was not found to moderate the association between student-teacher relationships and sense of belonging, nor was it found to moderate the association between cultural pluralism and sense of belonging.

How Race Impacts the Relationships Between Cultural Pluralism and Student-Teacher Relationships and Sense of Belonging

As hypothesized, race moderated the relationship between cultural pluralism and sense of belonging, supporting previous research findings that cultural pluralism can enhance the well-being and feelings of acceptance among students (Oczlon et al., 2021). However, our hypothesis that Black students would benefit more from the presence of high levels of cultural pluralism was not supported. The results showed that White students experienced a greater increase in sense of belonging as cultural pluralism increased compared to Black students. Contrasting findings among previous research have led to uncertainty as to whether cultural pluralism has a greater effect for students from minority racial

or if cultural pluralism affects all students equally (Brand et al., 2003; Celeste et al., 2019; Schachner et al., 2019). The findings from this study suggest that the sense of belonging of all students benefited from higher levels of cultural pluralism; however, White students showed a greater increase. An explanation for this effect may arise by viewing the racial makeup of the schools included in the sample. The student population across the 34 schools included 50.3% Black or African American students and 25.7% White students. Black or African American individuals are considered to be a part of a racial minority population in the US and the average US classroom; however, within the schools sampled, they made up a majority of the student body which might explain why White students, who were in the minority, showed a greater increase in sense of belonging at higher levels of cultural pluralism. Therefore, although our specific hypothesis of Black students benefiting more from cultural pluralism was not supported, our more general hypothesis of the minority student group being especially impacted and benefiting from cultural pluralism was supported. Previous research has claimed that minority populations feel more included in school when cultural pluralism approaches are implemented to value their identities, compared to when their identities are threatened, and they feel excluded or discriminated against (Celeste et al., 2019; Byrd, 2015). Thus, the findings suggest that cultural pluralism differentially impacts the level of increase in students' sense of belonging based on race, and the racial group that makes up the minority population, according to the racial makeup of the school, benefits more from the presence of cultural pluralism. Additionally, Black students in this study were found to have higher levels of sense of belonging overall compared to White Students, which further supports that the racial makeup of the school plays a role in which group feels more included.

While race was found to moderate the relationship between cultural pluralism and sense of belonging, it did not significantly moderate the relationship between student-teacher relationships. While greater teacher support did predict an increased sense of belonging among all students, aligning with previous research (Allen et al., 2021; Ibrahim & El Zataari, 2020; Scales et al., 2020; Visser & Arends, 2019), the relationship was not significantly different between White and Black students. The absence of a moderation effect on this relationship opposes prior studies that found that minority students, including Black or African American students, felt isolated due to teachers' lack of interest and cultural awareness (Kumi-Yeboah et al., 2021). Thus, previous research suggested that students of color have difficulty developing positive relationships with teachers due to feelings of discrimination stemming from teachers' insufficient cultural awareness and knowledge (Bjorklund, 2019; Boston & Warren, 2017; Tillman-Young, 2018; McClain, 2019). In contrast, the finding from this study implies that Black and White students' sense of belonging is not differentially impacted by teacher support. One explanation for this contrasting result may again be due to the school's racial makeup. Since Black students were the majority population within the sample, the schools may have had higher levels of cultural awareness among staff and less discrimination towards students of color that would hinder developing positive student-teacher relationships. Additionally, teacher support may affect sense of belonging through cultural pluralism, as teachers' cultural awareness and knowledge was found to greatly impact the development of positive student-teacher relationships (Bjorklund, 2019; Boston & Warren, 2017; Tillman-Young, 2018; McClain, 2019). Since cultural pluralism was found to be significantly moderated by race, teacher support may play more of a role in enhancing cultural pluralism then impacting sense of belonging differentially based on race, as cultural pluralism and teacher support were found to be significantly positively correlated to one another.

With the findings of this study, it is now better understood how cultural pluralism impacts students' sense of belonging differentially based on race and how the racial makeup and environment of the school may play a role in this relationship. Knowing how a school's racial makeup may impact sense of belonging among students and the efficacy of cultural pluralism in improving sense of belonging, schools can implement individualized programs that enhance feelings of inclusiveness and acceptance among students based on student demographics. For example, teachers can integrate lessons into their curriculums that focus on diversity and learning about other cultures, specifically those of students who are in the minority population, so students can learn about their peers and engage in discourse that highlights the value of differences. Overall, it has been shown that cultural pluralism and positive student-teacher relationships in schools overall benefits students' sense of belonging; thus, schools should focus on strengthening the connections between students and teachers and enhancing cultural awareness within the school environment, especially to improve feelings of belonging among the minority student population. Ensuring that students in the minority population have an opportunity to share their experiences and voice their opinions on the school environment through student forums or anonymous surveys could enhance feelings of inclusion. Additionally, staff representation can be beneficial in developing positive student-teacher relationships and a diverse environment where all students feel valued.

Limitations

This study has limitations which may have influenced the results. Our dataset contained an insufficient sample size to analyze all minorities and any intersectionality of racial or ethnic identities. This limitation influences the statistical generalizability of our findings, as we only focused on the races of Black and White and ethnicities of Hispanic and non-Hispanic. Our sample population, therefore, cannot be applied to every school setting, as each school setting has a different racial and ethnic makeup, which in turn differentially impacts the presence of cultural pluralism and teacher support. Another constraint to this study was the measurement of cultural pluralism using the Support for Cultural Pluralism Subscale, which only included 4-items and most likely did not assess all of the constructs of cultural pluralism that may impact sense of belonging. For example, items stated, "Your teachers show that they think it is important for students of different races and cultures at your school to get along with each other," and "Students of many different races and cultures are chosen to participate in important school activities." Students were not asked whether they felt that their own culture was valued or how other students treated them in relation to their culture. These perceptions and experiences may better explain how cultural pluralism impacts the sense of belonging based on students' race. More comprehensive measures that include items about students' own experiences may bridge the gap in research and increase knowledge on diverse populations.

Future Directions

   Research has found a significant positive correlation between teacher support and sense of belonging (Ibrahim & El Zataari, 2020; Oczlon et al., 2021). Supportive school environments are crucial to a student's academic success and emotional health. Our results show that greater cultural pluralism significantly predicted an increased sense of belonging while controlling for race. Further research should look at the implications of student-teacher relationships with minority students and the teacher's perspective to make changes accordingly. Therefore, a greater understanding of the needs of students and actions teachers and others in the school community can take to increase sense of belonging is needed. As research on cultural pluralism is scarce, further research is needed to assess teacher support's role in enhancing cultural pluralism in schools. Our study highlighted that the minority racial population within schools benefited more from a cultural pluralism environment, in this case, White students. Therefore, for future research, an analysis can be conducted on the impact of population racial makeup on cultural pluralism within school systems to highlight if this finding can be generalizable.

   Based on the findings of this study, we suggest several methods through which schools can bolster feelings of inclusion among minority student populations. First, schools should provide students with a platform to share their cultures with their peers. Celebrations of cultural and racial diversity in classrooms can show students that their differences are valued. Further, hosting student forums or distributing anonymous surveys that allow students to voice their feelings, opinions, and concerns about their school's environment could ensure that minority students feel they have a way to be heard. Teachers should strive to get to know their students better to be more aware of their needs and better address problems, considering the student's identity. Additionally, schools can integrate diversity into the curriculum by teaching cultural lessons, reading books that reflect diversity, and engaging in discussion with students that allows them to ask questions. Finally, ensuring that schools hire teachers from different racial and ethnic backgrounds enhances school representation, impacting students' sense of belonging.

Conclusion

This study examines how student-teacher relationships and cultural pluralism are associated with sense of belonging outcomes among middle school-aged students. While previous literature studied these models independently, the potential moderating effect of race and ethnicity on the relationships between cultural pluralism and sense of belonging, and student-teacher relationships and sense of belonging, is a relatively new area of research. This study supports past findings that higher reports of cultural pluralism and positive student-teacher relationships are associated with an increased sense of belonging in middle school students. However, ethnicity was not found to moderate either of these relationships. While race was not a significant moderator in the association between student-teacher relationships and a sense of belonging, race moderates the relationship between cultural pluralism and a sense of belonging. When cultural pluralism is high, White students displayed a larger increase in their sense of belonging than their Black peers. Given that Black students are the majority racial group across the middle schools within our sample, our results suggest that it is the minority racial population within schools that benefit more from a cultural pluralism environment.

The findings of this study not only bridge gaps in the literature regarding the sense of belonging in middle school students but also emphasize the importance of teacher support and cultural acceptance.

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Meet the author:

 My name is Jennifer Persia, and I am a Senior earning a B.S. in Psychology with minors in Neuroscience and Modern Hebrew! I am a research assistant at the Abramowitz Anxiety and Stress lab, and an alumn of the Karen M. Gil internship program. I am involved on campus as one of the UNC Out of the Darkness Walk planning co-chairs, fundraising through the American Foundation for Suicide Prevention to support mental health research, outreach, and advocacy. I am also involved in several other campus organizations including the executive board of UNC Psi Chi (the psychology honors society), the social media and outreach committee for the UNC Bandana project, and I am a first-year outreach co-chair for the UNC Mental Health Ambassadors. I am passionate about mental health care and destigmatization and aspire to contribute to these critical issues as a therapist. Next year I will continue my mental health education and advocacy by pursuing my Master of Social Work at UNC! For my senior honors thesis research project, I am examining the impacts of wearable fidget technology on anxiety, stress, and attention through a Randomized Controlled Trial (RCT).

Examining the Impacts of Subtle Fidget Jewelry on Anxiety, Stress, and Attention

Jennifer R. Persia

Abstract

Fidgeting is something most humans naturally do to self-stimulate and soothe, and is known to release neurotransmitters that stimulate attention and sharpen focus while decreasing cognitive load. Accordingly, it is an important part of sensory-motor self-regulation and has been hypothesized to play a key role in regulating attention. Fidgeting may also have the added potential of reducing anxiety and stress. Fidget tools are mass-produced and highly popularized for Attention Deficit Hyperactivity Disorder (ADHD). The research on fidget impacts is limited, particularly in sub-clinical adult populations. In this study, a non-clinical sample of 51 healthy adults were randomly assigned to receive a fidget ring or a placebo non-fidget ring. Participants were instructed to wear their assigned ring for one week and answer daily surveys measuring self-reported anxiety, stress, attention, and engagement with the assigned ring. Post-test results of the experimental group demonstrated a decrease in anxiety levels with a moderate effect size ($\eta p2 = 0.93$), while the control group experienced no change in anxiety levels. This finding is consistent with the idea that having access to fidgets allows individuals to self-regulate their anxiety levels by self-soothing and may calm the nervous system, serving as an outlet for expelling nervous energy that may be associated with somatic symptoms of anxiety. Further research is necessary to elucidate the mechanisms behind how fidgets reduce anxiety. Future research should examine longer-term use of fidgets and impacts on individuals with anxiety disorders

Keywords: fidgets, fidgeting, anxiety, stress, attention, focus, fidget rings, ConqeRING
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Examining the Impacts of Subtle Fidget Jewelry on Anxiety, Stress, and Attention
Proposed Benefits of Fidgeting

Fidgeting is something every individual naturally does with their body. However, there is limited research directed toward portraying the benefits of this innate behavior. Physical activity, even small tactile movements, releases the neurotransmitters dopamine and norepinephrine which is linked to increasing attention and sharpening focus (Schecter, 2017). Fidgeting behaviors such as tapping, swinging, doodling, and clicking may allow individuals to self-stimulate in order to elicit physiological and psychological benefits. Humans seek to alter their environments to provide just the right level of stimulation (Isbister, 2017). Many individuals are motivated to fidget for the sole purpose of achieving basic stimulation and these types of sensory-motor activities are natural adjustments especially when an activity cannot sustain attention on its own (Karlesky, 2016; Rotz, 2021). In addition to the potential benefits fidgeting may exert on attention, it may also have the capacity to redirect the flow of thoughts in a way that promotes calmness and reduces anxiety (Karlesky, 2016).

Fidget devices are self-regulation and occupational therapy tools that are often used by students to increase concentration, decrease anxiety, and strengthen fine motor skills (Schecter, 2017). Some examples of fidgets include stress balls, putty, fidget spinners, and fidget cubes (Soares, 2019). Fidget devices are often recommended to children with Attention Deficit Hyperactivity Disorder (ADHD) to help them focus in classroom settings. To better understand the possible benefits of engaging with fidget technology, we must first examine how fidget devices have been implemented to help individuals with ADHD.

Fidgeting for children with ADHD
FIDGET RINGS FOR STRESS, ANXIETY, AND ATTENTION

Much of the previous research dedicated to understanding the impacts of fidget technology has centered around children with ADHD. Fidget devices have been popularized as tools to help children with ADHD focus, primarily in classroom settings. Researchers have shown that when children with ADHD are asked to perform attentional tasks, they will naturally increase the frequency of their movements, and this movement may serve as a compensatory mechanism to facilitate cognitive function (Sarver, 2015).

For children with ADHD, higher levels of gross motor activity are correlated with better performance on working memory tasks, whereas the opposite is seen for their typically developing peers (Sarver, 2015). During cognitive control tasks, higher-intensity ankle movement corresponds to more correct trials than incorrect trials (Hartano, 2016). These findings suggest that for children with ADHD, cognitive control functioning and working memory are enhanced by more intense activity and movement. Based on this demonstrated need for movement and motor stimulation in children with ADHD, fidget devices might be considered a logical intervention that provides motor stimulation to increase sustained attention during tasks.

Fidget devices may be beneficial tools in classroom settings where children with ADHD need to sustain attention for long periods. Hand and foot fidgets have been shown to increase attentive behavior by 45-55% from baseline for elementary school students with ADHD, with performance plummeting after fidget devices were removed from the classroom (Mathews, 2018). For children with ADHD, fidget devices may also decrease off-task behaviors during instruction. In a similar tested population, the use of fidget tangle toys for fine motor movement and tactile stimulation correlated with fewer off-task behaviors during instruction, though performance on mathematical tasks remained unchanged (Kercood, 2007). These findings may indicate that fidget devices helped students soothe and self-regulate, but did not aid in absorbing information. Throughout the limited fidget research, there is evidence that children with ADHD may benefit from additional sensory-motor stimulation and access to fidget tools may provide an outlet to meet this need.

Improved Attention in Sub-clinical Samples

Research on subclinical populations has broadened the scope of individuals that may benefit from deliberate sensory-motor stimulation. It is thought that in general fidgeting improves performance by stimulating areas of the brain that integrate tactile information; the primary motor cortex and the somatosensory cortex (Schecter, 2017). Hand movements have been shown to increase the levels of dopamine and norepinephrine in a similar way to ADHD medications (Rotz, 2021).

Tactile stimulation can be beneficial in regulating and modulating attention, providing just the right level of sensory input to sharpen focus and calm the nervous system (OTFC, 2022). During cognitively challenging tasks, Functional Near-infrared Spectroscopy (fNIRS) of prefrontal cortex activity has shown decreased activity among experimental groups using fidget devices during cognitive tasks as compared to control groups (Koiler, 2021). Behavioral performance on cognitive tasks was not impacted by this reduction in PFC activity. Researchers have interpreted these results to indicate that fidgeting leads to greater efficacy in more cognitively challenging tasks (Koiler, 2021).

In a qualitative survey of adult populations, researchers questioned individuals about the diverse items that individuals keep within their workspaces and how they impact focus and mood (Karlesky, 2016). Participants affirmed hypotheses that fidgeting, fiddling, doodling, and other repetitive behaviors helped with self-regulation of creativity, focus, and calmness. Participants noted that these actions sparked their thinking, increased concentration, and enhanced their ability to listen to others (Karlesky, 2016).

A non-clinical population of sixth graders who were provided with stress balls during instruction noted that the fidget devices calmed them down and helped them focus (Stalvey, 2006). Improvements in their performance were also noted in class writing scores which improved after stress balls were introduced to the classroom (Stalvey, 2006). Purposeful movement integrated into math class instruction produced significant gains in post-test scores compared to students in a control group that engaged in the same lesson without the movement component (Beudoin, 2011). The act of incorporating movement into the lesson resulted in post-test scores of 84% compared to 65.9% in the control group class (Cohen's d= 0.82; Beaudoin, 2011).

Contradictory evidence: Potential Negative impacts of Fidgeting on Attention

As discussed previously, even in samples of clinical populations with ADHD diagnoses, some fidget research has indicated drawbacks of using fidget devices (e.g. potential to increase cognitive load, distraction, and poorer or unimproved performance on tasks). In both clinical and subclinical populations, there are additional contradictory findings that confound the evidence of fidget device benefits. Fidget spinner use amongst children with ADHD in a classroom setting led students to commit significantly fewer "area" violations while corresponding to significantly greater "attentional" violations during observation (Graziano et al., 2020). This indicates that fidget devices helped children reduce their disruptive movements (e.g. getting up out of their seats), but distracted their ability to attend to classroom activities. In fact, some teachers report fidget devices to be major visual and auditory distractions to the classroom environment (Schecter, 2017). In adult populations there may also be risk for distraction. University students who utilized fidget devices during educational videos suffered greater attentional lapses than non-fidget control groups and performed worse on memory post-tests (Soares, 2020).

It appears likely that fidget devices have the capacity to be misused, and have the potential to be more distracting than beneficial in some settings.

Reduction in Anxiety and Stress

Stress and anxiety are related to the sympathetic nervous system's fight or flight response. While stress is normal and designed to help you adapt to unexpected situations, chronic stress can lead to negative long-term health outcomes such as a weakened immune system, increased risk of cardiovascular conditions, impaired memory and learning skills, and can even shorten life expectancy by 15 to 20 years (Abramowitz, 2012). In the body, stress has 3 domains of responses; physical reactions like sweating, racing heart, and shakiness, mental reactions such as racing thoughts and catastrophizing, and behavioral reactions like anger and avoidance (Abramowitz, 2012). Fidgeting may impact stress reduction by acting on the domain of physical reactions, providing a safe method to expel nervous energy through intentional movement.

The body of evidence linking fidget devices to decreased anxiety and stress is smaller than the body of attentional research but still very promising. In situations that may be overwhelming, engaging in simple, repetitive movements may allow individuals to disregard distractions and reduce their stress and anxiety (Komay, 2022). Anxiety is an intense feeling of apprehension or fear that may occur without the presence of a stressor and can produce symptoms such as uncontrollable worrying and loss of sleep (Abramowitz, 2012). Clinical anxiety typically relates to chronic daily overestimations of threats and requires professional treatment; the gold standard of anxiety treatment is exposure therapy (Abramowitz, 2013). Fidgeting is not a means of curing anxiety, but it may serve as an effective method to help individuals cope with distress through self-soothing, providing satisfying temporary relief (Komay, 2022).

Participants in the previously discussed Karlesky (2016) self-regulation study indicated a reduction of anxiety and stress from the use of fidget devices within their workspaces, reporting that fidgets were "handy in moments of stress" and "calming". Many participants also discussed finding pleasure in these behaviors (e.g. "it is way more fun", "I was delighted to discover [these] made the perfect fidget toy", "this thing is so pretty and feels so nice", p. 7). Experimental evidence on distraction techniques for children undergoing dental anesthesia found that compared to kaleidoscopes, virtual reality, and controls, fidget spinners were the most effective tool for reducing anxiety self-reports and decreasing pulse rates (Aditya, 2021).

Clarifying the Impacts of Fidgeting on Anxiety, Stress, and Attention

The present study seeks to clarify the impacts of fidgeting on attention, anxiety, and stress in a non-clinical adult population and adult fidgeting remains under-studied. The company CONQERing has developed fidget rings that individuals can wear in any setting for subtle sensory-motor stimulation. These rings are marketed for anxiety reduction, mood improvement, and focus. In this study, adults aged 18-64 were randomly assigned to a fidget ring condition or to a similar-style control ring without built-in movement capabilities. Participants were asked to wear their assigned ring for one week and provide daily self-reports of anxiety, stress, and attention, and indicate how much they fidgeted with their assigned ring that day. We hypothesized that wearing a subtle CONQUERing fidget ring for stimulation throughout the day would reduce daily self-reports of anxiety and stress, and improve self-reported attention.

Method
Participants
Participants were adults ages 18-64 (M= 30.73, SD =13.71) living in North Carolina and recruited through flyers, social media posts, and the SONA participant database. A total of 51 participants consented to be in the study. Seven did not complete the final survey, and thus were not included in the statistical analysis. The final sample size analyzed was 44 (23 control, 21 experimental).

Measures
DASS-21
The 21-item Depression Anxiety and Stress Scale (DASS-21) was administered to assess self-reported emotional states of anxiety, stress, and depression. This measure has been shown to demonstrate good internal consistency and psychometric properties across diverse populations of adults (Tran, 2013; Park, 2020; Moya, 2022; Coker, 2018). The DASS-21 questionnaire asks
participants to rank experiences over the past week on a 4-point Likert scale from 0 "did not
apply to me at all" to 3 "applied to me very much or most of the time". Seven prompts assessing stress included the statements "I found it hard to wind down," and "I found it difficult to relax". Stress is ranked on a scale from "normal" to "extremely severe" based on scores (i.e. normal 0-14, mild 15-18, moderate 19-25, severe 26-33, extremely severe 34+). Anxiety was assessed with seven prompts including "I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in absence of physical exertion)" and "I was worried about situations in which I might panic and make a fool of myself". Anxiety scores are ranked from "normal" to "extremely severe" (i.e. normal 0-7, mild 8-9, moderate 10-14, severe 15-19, extremely severe 20+). The Depression dimension included seven prompts such as "I felt that I had nothing to

look forward to" and "I felt that I wasn't worth much as a person". Depression scores are ranked from "normal" to "extremely severe" (i.e. normal 0-9, mild 10-13, moderate 14-20, severe 21-27, extremely severe 28+). The DASS-21 is scored by summing ratings for each subscale and multiplying scores by two. We utilized the DASS-21 as a predictor of the outcomes of the experimental manipulation.

Our outcome measures were self-reported anxiety, stress, and attention. Each item was assessed on a 7-point Likert scale ranging from 1 "not stressed/focused/anxious at all" to 7 "always stressed/focused/anxious". Stress and anxiety were differentiated within the prompts using APA definitions. Stress was defined as "mental and physical symptoms, such as irritability, anger, fatigue, muscle pain, digestive troubles, and difficulty sleeping" and anxiety as "persistent, excessive worries that don't go away even in the absence of a stressor" (Alvord, 2022).

Ring Engagement

Participants were also asked to rate on a 7-point Likert scale the extent to which they engaged with their ring each day of the study period. Participants rated their engagement (e.g. fidgeting, moving it around) on a scale from 1 "not at all" to 7 "very often". This measure was used to control for the fidgeting of the placebo rings, which are not designed for fidgeting but can still be moved around and played with. We were interested in examining group differences in fidgeting frequency.

Procedure

Participants recruited from flier postings, social media, and SONA were instructed to reach out to the principal investigator to schedule a 15-minute enrollment appointment.

Enrollment appointments were conducted either in person (in a laboratory space) or virtually. During enrollment, the experimenter reviewed a consent form and asked participants to sign this form. Next, participants were directed to complete a secure virtual survey including a short demographic questionnaire, an index finger ring sizing, necessary mailing information for ring shipping, as well as the DASS-21, and Likert scales measuring anxiety, stress, and attention self-reports. Utilizing random assignment, participants were placed into either the experimental fidget ring group or the control placebo ring group. Although participants were blind to which condition they had been assigned, the experimenter was not blinded. Participants received their assigned rings in the mail and were instructed to wear them the week of November 14th-20th. A baseline day 0 survey was sent out the day before the trial period began, and participants were instructed to indicate their anxiety, stress, and attention levels prior to the intervention. During the intervention period, participants received a survey each day assessing their self-reported anxiety, stress, attention, and the extent to which they engaged with their assigned ring. On day seven participants were debriefed on the experimental manipulation and thanked for their contribution to the research.

Data Analyses

First, descriptive statistics were analyzed to characterize the demographics of the sample. Second, a t-test comparing groups on fidgeting behavior during the trail was conducted as a manipulation check. Third, to examine the effects of the experimental manipulation, a two-way repeated measures ANOVAs (time [baseline, posttest] by condition [experimental ring, control ring]) was completed for each outcome measure. Follow-up t-tests were conducted for each significant interaction effect to examine which mean differences were significant.

Results

Descriptive Statistics

Participants enrolled in the study ranged from ages 18 to 64 years (M= 30.73, SD= 13.71). The majority of participants (66.7%) identified as white, 7.8% identified as Asian, 5.9% as Black or African American, 17.6% identified as Multi-racial, and 2% identified with other unspecified racial backgrounds. DASS-21 scores were calculated for each subscale for the control group; Depression (M= 14.08, SD= 10.545), Anxiety (M= 14.00, SD= 8.854), and Stress (M= 17.85, SD= 7.958). For the experimental group, DASS-21 scores were slightly lower in all subscales; Depression (M= 9.76, SD= 7.965), Anxiety (M= 9.28, SD= 8.080), and Stress (M= 17.36, SD= 8.577). Overall these scores fell within the non-clinical range and indicated that the sample was generally non-distressed. See Tables 1 and 2 for details.

Manipulation check

To examine whether there were any differences in fidgeting behavior between the experimental and control groups, we compared participants' self-reported daily fidgeting behavior. When averaged across the seven days of data collection, the experimental (M=4.06, SD=1.04) and control (M=4.06, SD=1.40) groups reported engaging in a moderate amount of fidgeting. A t-test revealed no significant differences between groups, t(46)= 0.014, p= 0.989, d= 0.004.

Primary Outcomes

Means and standard deviations for both groups at both time points can be found in Table 3. A repeated measures ANOVA of anxiety self-report measures revealed a significant effect for time $F_{(1, 42)}$= 5.086, p= 0.029, ηp2 = 0.108, but not for condition $F_{(1, 42)}$= 1.868, p= 0.179, ηp2 = 0.043, however, the time by condition interaction was significant, $F_{(1, 42)}$= 4.308, p = .044,

with a medium effect size of ηp2 = 0.93. Post hoc t-tests indicated a significant reduction in anxiety between pre and post-tests for the experimental group, t(20)= 2.75, p = 0.012, d= 0.60, but not for the control group, t(22)= 0.143, p = 0.888, d= 0.030. Post hoc tests showed no differences at pre-test, t(48)= 0.514, p = 0.610, d= 0.145, but a significant difference between control and experimental groups at post-test, t(42)= 2.403, p= 0.021, d= 0.725. Specifically, the experimental group evidenced lower anxiety scores at post-test than did the control group.

A repeated measures ANOVA of stress self-report measures revealed a significant effect for time, $F_{(1, 42)}$= 12.853, p= .001, ηp2 = 0.234, but not condition, $F_{(1, 42)}$= 3.515, p= 0.068, ηp2 = 0.077, and the time by condition interaction was non-significant, $F_{(1, 42)}$= 1.195, p = 0.280, ηp2 = 0.028.

A repeated measures ANOVA of attention self-report measures revealed a non-significant effect for time, $F_{(1, 42)}$= 2.577, p= 0.116, ηp2 = 0.58, and condition $F_{(1, 42)}$= 0, p= 0.991, ηp2 = 0.

Discussion

The research on the impacts of fidget technology is mixed and inconclusive, and most of the studies conducted pertain strictly to children with ADHD. Fidget devices are widely used and the application of wearable fidget jewelry is gaining popularity. Fidgeting behaviors that seem insignificant may have the capacity to help individuals throughout daily life–for example, by helping them self-regulate and self-soothe. We were interested in examining the potential benefits of fidgeting for a non-clinical sample of adults. The "CONQUERing" rings we examined are marketed as tools to help reduce anxiety. Accordingly, we tested the hypothesis that wearing this particular type of fidget technology would reduce anxiety and stress, while improving one's ability to focus and pay attention.

Our analyses revealed that wearing a CONQUERing over the course of one week had a moderate effect on anxiety reduction relative to a control (non-fidget) ring. This finding is consistent with the idea that having access to fidget devices allows individuals to self-regulate their anxiety levels throughout the day by self-soothing and providing a distraction from distress. It is possible that deliberate fidgeting calms the nervous system, serving as an outlet for expelling nervous energy that may be associated with somatic symptoms of anxiety. Importantly, we did not examine the mechanisms by which CONQUERing works. Thus, future research might further study such hypotheses.

We found no significant impacts of CONQUERing on stress reduction or on attentional focus. This was especially surprising for two reasons. First, one might hypothesize that changes in self-reported stress would mirror changes in self-reported anxiety. Moreover, most of the previous literature focuses on the potential impacts of fidget devices on attention and concentration. Perhaps the benefits of fidget device use that have been found with regard to performance are associated with calming the nervous system rather than increasing attentional control.

An important strength of the present study is that it was designed as a randomized controlled trial (RCT). The strength of the RCT design is that it allows researchers to elucidate whether the effects of the intervention are due to the specific nature of the intervention over and above non-specific factors present in all interventions. Examples of non-specific factors include; being part of a research study, expectations of change, and repeated assessment. In the present study, the only difference between groups was that the experimental group wore the CONQUERing, accordingly we can conclude that wearing a CONQUERing had a causal effect on anxiety reduction.

In addition, a manipulation check to determine how often each participant engaged with their assigned ring revealed no difference in the amount each groups fidgeted regardless of whether they were wearing a CONQUERing or a control ring. This suggests that over and above the simple act of fidgeting, the use of this particular ring has an effect on self-reported anxiety. Perhaps the integration of clicking and spinning sounds which connect somatosensory systems and auditory systems provides soothing feedback to the fidgeting individual that a non-fidget ring fails to provide. Our control rings had no capacity to make spinning or clicking sounds, thus only providing somatosensory feedback to fidgeters. Integration and stimulation of different sensory modalities may be key to the calming properties of well-designed fidget technology. There were several key limitations to this research. Due to random assignment, the experimental and control groups were not identical in their baseline DASS-21 scores. Specifically, the control group was more depressed and anxious than the experimental group. Another factor that may have influenced this study is comfort. As part of the post-test survey participants were given the opportunity to comment on their overall experience. Four individuals in the control group and two individuals in the experimental group reported finding their assigned fidgets uncomfortable. Perceived discomfort may have been a factor influencing outcome measures that we failed to account for. Another factor that we did not measure was how often participants remembered to wear their rings; we attempted to account for this factor by asking individuals how often they were engaged with their fidget ring that day with zero indicating "not at all" or that the ring was not worn. A few participants in the experimental group reported that the sounds associated with fidgeting made them self-conscious or that they found the design of the experimental rings confusing. These anecdotal reports are indicators that fidgeting is a highly individualized practice and that not everyone may derive benefit from the

same type of fidget technology. This study was also limited by duration; we only tracked outcome measures and the fidgeting behavior of participants for a one-week period. Moreover, we did not collect long-term follow-up data, and therefore do not know whether there are long-term effects of CONQUERing.

Future research could delve deeper into the mechanisms of fidgeting and anxiety reduction by assigning different types of fidget devices and seeing which ones have the greatest efficacy. Considerations for ring comfort and complexity may be incorporated into future studies with less complex ring designs or more comfortable placebos. Research in the future should look at the longer-term impacts of fidget technology on anxiety to see if over time DASS-21 anxiety scores might decrease from prolonged fidget device use. Additionally, this research would be very interesting to conduct with individuals with anxiety disorders to see if a clinical population might derive anxiety reduction benefits from fidgeting. This could be examined alongside clinical interventions for anxiety such as exposure therapy or CBT to see if it augments treatment.

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Development of a Novel Automatic Counting and Batch Processing Program for Chlamydia Inclusion Quantification

Matthew Lu

Abstract

Current efforts to create a Chlamydia vaccine rely heavily upon inclusion forming assays. The gold standard of quantifying Chlaymdia inclusion forming units relies heavily upon manual counting. However, this method is extremely time consuming and can be unduly influenced by internal biases. In this paper, we demonstrate a novel method of using the EVOS microscope and Celleste Imaging Analysis Software to design macros that can be used to batch process multiple fields and count them automatically. This method is quick, analyzing 40 fields in 10 minutes, and accurate, when compared to manual counts, demonstrating its utility for large scale studies.

Introduction

Chlamydia trachomatis is the most common sexually transmitted bacterial disease in the world (2). The CDC estimated 4 million infections in the United States in 2018 (7). However, the reported incidence of Chlamydia is underestimated since 50% of men and over 70% of women do not exhibit symptoms (2). This is a major public health problem, as untreated infections can adversely affect the reproductive system of both men and women and cause infertility in women (3). The high incidence of asymptomatic infections and the severity of untreated infections demonstrate that, even with effective antibiotic treatment, the best method to control Chlamydia infections is with a vaccine (2, 3). Studies have shown that even a partially effective chlamydial vaccination program would significantly reduce the incidence of chlamydial infection (2).

An essential part of vaccine research is animal modeling. Animal models are necessary for vaccine development and preclinical testing (2). The Chlamydia muridarum mouse infection model has commonly been used for immunology and vaccine studies (2, 3). Chlamydia muridarum was originally isolated from the mouse respiratory system, but is now used to model genital infection (3). The difference between Chlamydia muridarum and Chlamydia trachomatis is minor as their genome is very similar except for a small portion, around 50kb, in Chlamydia murdiarum called the plasticity zone (3). The similarity between the two Chlamydia species allows mouse models to be extrapolated to humans, and thus is an integral part of vaccine development. Furthermore, C. muridarum vaginal infection in mice has a similar pathology to women, with infection of the cervical epithelial cells that eventually infects the upper genital tract (3). C. muridarum also has an almost universal infection rate across different strains of mice while infection with C. trachomatis differs depending on strain (3).

Therefore, it is more convenient and efficient to use C. muridarum for vaccine trials as it has a higher infection rate for more strains of mice as well as being similar enough to have results extrapolated to human disease. All species of Chlamydiae have a similar developmental cycle (8). Chlamydia are obligate pathogens and alternate between a non-infectious, metabolically active, intracellular reticulate body (RB) and an infectious, inert, extracellular elementary body (1, 3, 5, 8). Inside the host cell the RBs form inclusions within a vacuole (5). The RBs incubate within the inclusion and begin a period of exponential replication (8). After replication, the RBs are differentiated into elementary bodies which are then released into the extracellular space to infect more cells (5, 8). One method to test for vaccine efficacy is to infect mice with Chlamydia and compare the amount of viable bacteria over time between vaccinated and unvaccinated mice (1). Quantification of infection is usually done by fixing confluent monolayers of cells that have been infected by Chlamydia with methanol and counting the inclusion forming units (IFU) (4). To do so, the inclusions are stained with antibodies for immunofluorescence microscopy and the IFUs are counted by hand (4). However, this process is laborious and time-consuming (4). Furthermore, the process of manually counting IFUs can introduce error and bias (4). Due to the fact that manual counting inclusions is extremely repetitive and monotonous it can lead to fatigue and complacency, which increases the probability of errors, especially in large batches. Furthermore, investigator bias can unconsciously lead to unintentionally manipulating the data. This is usually alleviated by having others blind counting samples, but this once again introduces error from introducing an additional person as well as multiplies the manpower needed to successfully count inclusions. Therefore, creating an automated high-throughput system to automatically count IFUs can provide better and faster quantification of bacteria and provide experimental rigor by reducing error and bias.

The goal of the experiment was to compare the automatic counting done by the Celleste Imaging System to that of manual counting in order to determine if it can be used as a replacement or alternative to manual counts. We found that the automatic counts were not significantly different from the manual counts and the percent difference was low enough to be reliably used for IFU assay quantification.

Methods
IFU Assay
L929 cells (mouse fibroblast cells) were incubated at 37°C and 5% CO_2. The cells were resuspended via pipetting and 1 mL was aliquoted to count cell numbers. The solution was diluted 1:1 with Trypan blue and 10 µl was placed on the hemocytometer to quantify the cell concentration. The overall solution was then diluted for a final cell concentration of 1.9×10^5 cells/mL. 200 µl were placed into each well of a 96 well plate and the plate was moved side to side gently to evenly spread out cells. The plate was then incubated for 2-4 hours at 37°C and 5% CO_2. After incubation the plate was checked for a confluent monolayer. Vaginal swabs taken from mice infected with C. muridarum were placed in 1.0 mL transport buffer and 1.3 mL of IFU media was added to each swab tube. Each tube was then vortexed for 1 minute. A set of 1:10 serial dilutions was then added to the 96 well plate. 400 µl from the swab tube was placed in the neat well. 100 µl were then taken from the neat well and placed in the next well and 900 µl of media was added. 30 µl was taken from well 2 and added to well 3 and again 270 µl of media was added. This step was repeated for wells 3 and 4.

In between each dilution the wells were pipetted up and down to ensure a representative sample was taken. The wells containing Chlamydia were then aspirated while the border wells retained media in order to minimize evaporation of infected wells. 200 µl of each dilution was then added to the L929 plate and remaining samples were frozen at -80°C. The plate was then spun at 3000 RPM for 1 hour at 37°C and subsequently incubated for 16-24 hours at 37°C and 5% CO_2. IFU media was then removed from plate and 100 µl of ice cold methanol was added to each well and incubated overnight at 4°C. The plate was then washed three times with 1X PBS. Next, 50 µl of warmed Megablock (5% gelatin, 3% milk, 1X PBS) was added to each well and incubated for 30 minutes at 37°C and 5% CO_2. The plates were washed with 1X PBS at 37°C. 50 µl mouse anti-chlamydia LPS was diluted 1:500 with 1X PBS and 50 µl was added to each well and incubated for 45 minutes at 37°C and 5% CO_2. The primary antibody was dumped and the plate was washed 3 times with 1X PBS. A solution of 3 µL of 2mg/mL Alex Fluor 488 anti-mouse IgG, 6 µl Evans blue (0.667g in 100mL 1X PBS), and 6 mL 1X PBS was created and 50 µl of this solution was added to each well. The plate was incubated for 45 minutes at 37°C and 5% CO_2. The secondary antibody solution was dumped and washed 3 times with 1X PBS. One drop of 90% glycerol was added to each well and the plate was stored at 4°C.

Bacterial Transformation
The omcA::gfp reporter plasmid was added to C. trachomatis L2/434/Bu mutants P22 and M2C6 through bacterial transformation as detailed in (10). Bacteria were selected through penicillin resistance and expressed mCherry constitutively while GFP expression began at 24h.

S1 neat	S1 1:10	S1 1:100	S1 1:1000	S1 1:10000	S7 neat	S7 1:10	S7 1:100	S7 1:1000	S7 1:10000	
S2 neat	S2 1:10	S2 1:100	S2 1:1000	S2 1:10000	S8 neat	S8 1:10	S8 1:100	S8 1:1000	S8 1:10000	
S3 neat	S3 1:10	S3 1:100	S3 1:1000	S3 1:10000	S9 neat	S9 1:10	S9 1:100	S9 1:1000	S9 1:10000	
S4 neat	S4 1:10	S4 1:100	S4 1:1000	S4 1:10000	S10 neat	S10 1:10	S10 1:100	S10 1:1000	S10 1:10000	
S5 neat	S5 1:10	S5 1:100	S5 1:1000	S5 1:10000	S11 neat	S11 1:10	S11 1:100	S11 1:1000	S11 1:10000	
S6 neat	S6 1:10	S6 1:100	S6 1:1000	S6 1:10000	S12 neat	S12 1:10	S12 1:100	S12 1:1000	S12 1:10000	

Table 1. Serial dilutions performed for IFU assay.

Inclusion Quantification

To quantify inclusions, the EVOS M7000 Imaging System by ThermoFisher was used to capture images and the Celleste Imaging Analysis Software by ThermoFisher (Version 5.0.3 Build 7116) was used to count inclusions. A scan was taken for 25% of the well area starting from the center of the well using the 20x objective with the GFP fluorescent filter. The Celleste software was used to automatically scan and count inclusions based on previously established measurement criteria. The automated counts were compared against a blinded manual count. To perform the manual counts macros were created within the program as the batch processing system is not completely coded in and simply runs user created macros. These particular macros were made according to the Thermofisher manual (9). Three macros are required in order to run the batch analysis process: the "Run Before", "Loop On", and "Run After" macros. Macros were created within the Celleste program as there is no native batch processing system. The "Run Before" and "Run After" macros were created according to pg. 256-258 of the Thermofisher manual and the "Run On" macro was created according to pg. 248 – 250 (9). The .iqo file used with each "Run On" macro was created according to pg. 57-66 (9). The Celleste counts were then compared against the manual counts.

Culture conditions and IFU quantification by immunofluorescence

From the stained inclusions, 10 wells were selected for imaging, A1-4, B3-4, and C1-4. B1-2 were excluded as some fields did not have any fluorescent inclusions which would affect the counting program and analysis. From each of these wells, two fields were taken for mCherry and GFP fluorescence. Each field was manually counted and then counted with the batch processing macros and averaged to obtain an average count for each field before comparison.

Results

With the staining and imaging settings described in the Materials and Methods section, we were able to obtain images that could then be analyzed by the Celleste program (Fig. 1-4).
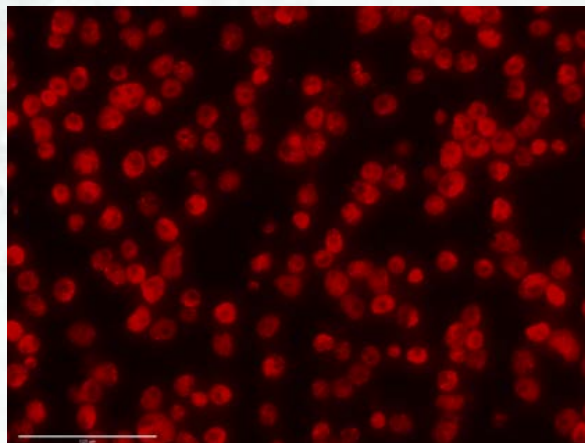

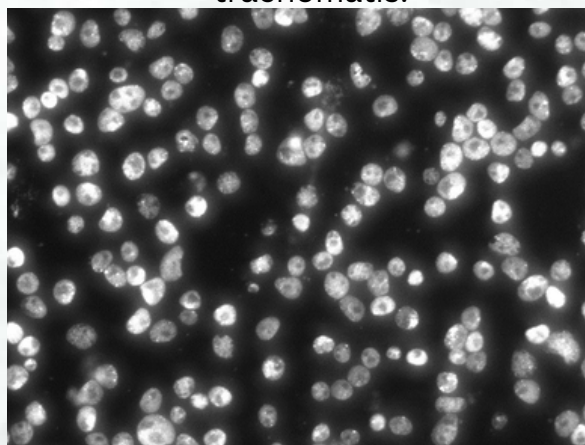Figure 1. Image of mCherry+ fluorescent Chlamydia trachomatis.

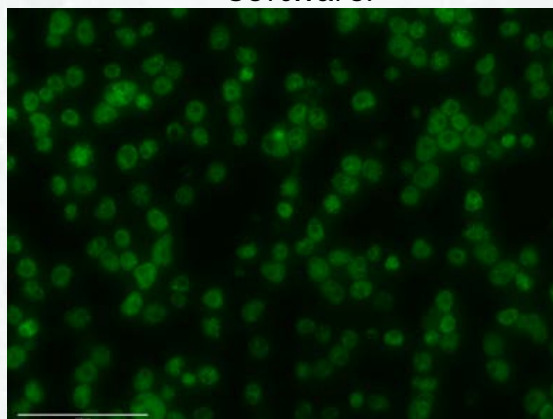Figure 2. Representative image of Fig. 1 used to program automatic counting in Celleste Software.

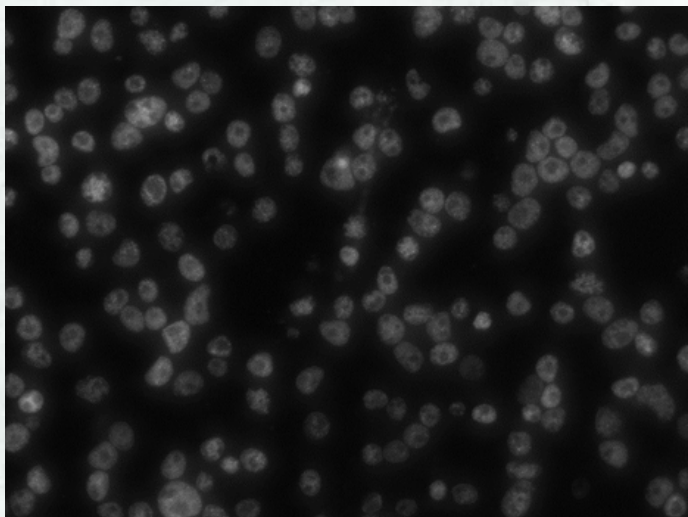Figure 3. Representative image of GFP+ fluorescent Chlamydia trachomatis.

Figure 4. Representative image of Fig. 3 used to program automatic counting in Celleste Software.

Well	mCherry		GFP	
	Automatic	Manual	Automatic	Manual
A1	181	130	213	123
	135	179	141	176
A2	176	145	196	139
	144	179	151	171
A3	158	170	173	155
	165	157	185	158
A4	147	162	139	151
	154	150	144	135
B3	135	149	153	147
	142	138	171	140
B4	104	119	116	119
	110	106	128	106
C1	158	173	181	172
	169	159	196	159
C2	177	180	204	183
	174	182	200	180
C3	144	199	123	166
	195	153	154	123
C4	109	160	64	110
	115	180	59	115

Table 2. Raw automatic and manual counts for each well.

A measurement .iqo file was created based on the raw images of Well A2 replicate 2 for both the mCherry and GFP inclusions. The raw files were then collated into a single folder that was analyzed with macros created utilizing the new .iqo file. The mCherry+ inclusions overall were higher quality images than the GPF+ inclusions with higher intensities and more defined contrast with the background.
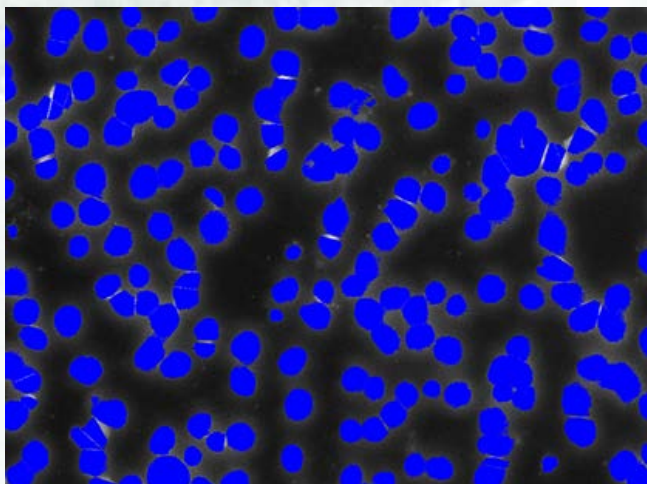
Figure 5. Example of Celleste image processing applied to image in Fig. 2.

From this we processed and automatically counted 40 fields in total with two replicates for mCherry and GFP per well.

The program counted around 100-200 inclusions per field with the exception of a few outliers. Furthermore, well C4 had inconsistent fluorescence compared to the other wells which lead to more irregular shapes, as well as dimmer intensity for both mCherry and GFP.

The automatic and manual counts were then averaged to obtain an average count per well, and then a percent difference between the two was calculated. Overall, 17/20 of the wells had a percent difference below 15%, though 9/10 of the mCherry+ wells had percent differences below 5% while 7/10 of the GFP+ wells had a percent difference greater than 10%.

Well	mCherry			GFP		
	Automatic	Manual	Percent Difference	Automatic	Manual	Percent Difference
A1	158	154.5	2.265372168	177	149.5	18.39464883
A2	160	162	1.234567901	173.5	155	11.93548387
A3	161.5	163.5	1.22324159	179	156.5	14.37699681
A4	150.5	156	3.525641026	141.5	143	1.048951049
B3	138.5	143.5	3.484320557	162	143.5	12.89198606
B4	107	112.5	4.888888889	122	112.5	8.444444444
C1	163.5	166	1.506024096	188.5	165.5	13.89728097
C2	175.5	181	3.038674033	202	181.5	11.29476584
C3	169.5	176	3.693181818	138.5	144.5	4.152249135
C4	112	170	34.11764706	61.5	112.5	45.33333333

Table 3. Averaged cell counts and percent differences for technical and biological replicates.

From this data, we performed statistical analyses of the manual and automatic counts to determine how variable they are from each other, which is summarized in Figure 5. The difference between the manual and automatic counts was not statistically significant with the paired t-test showing a p>0.05.
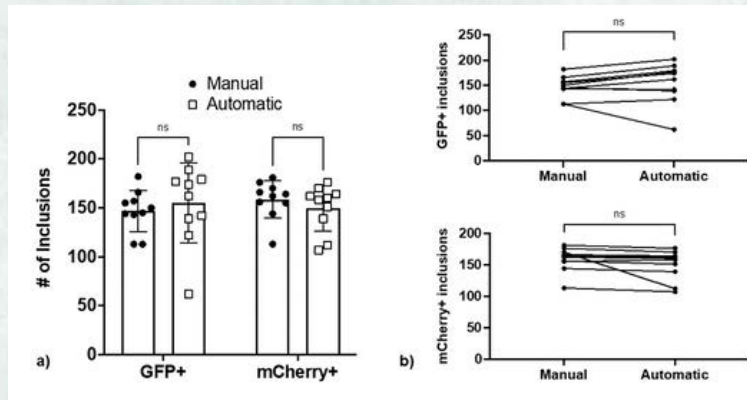

Figure 5. Automated counting using Celleste software provides comparable accuracy to manual counting. (a) Summary data for total number of GFP+ (p=0.7706) and mCherry+ (p=0.7302) inclusions. Statistical significance determined by two-way repeated measures ANOVA. (b) Pairwise comparisons between manual and automated counting for GFP+ (p=0.3067) (top) and mCherry+ (p=0.1463) (bottom) inclusions. Statistical significance determined by paired t-test. Statistical significance defined as p<0.05 (ns; not significant).

Discussion

Manual counting of Chlamydia is slow and laborious for large scale mouse studies, due to the large number of samples collected (4). This can lead to skewing of the data, either through fatigue and complacency-induced mistakes or investigator bias. Thus, the use of an automated program to count inclusions would greatly expedite the counting process and provide a more rigorous and unbiased way to quantify the number of inclusions. To address this, we investigated the ability of EVOS and Celleste Imaging Software to perform high throughput analysis and automated counting of chlamydial inclusions.

Overall, statistical analysis of the two counts showed that the difference between the automatic and manual counts was not statistically significant. Since manual counting is currently the gold standard for counting inclusions, the lack of a statistically significant difference indicates that the automatic count is fundamentally similar enough to manual counting to be used to quantify inclusions (4). 90% of the mCherry samples and 80% of the GFP samples had a percent difference of less than 15%. Due to the nature of serial dilutions for samples, it is not necessary for the automatic count to be exactly the same, as the standard of the manual count. In fact, a percent difference of less than 15% is likely sufficient accuracy, however this will require testing in further experiments. However, this method is limited by the consistency of the inclusions. For plates with poorer fluorescence or greater variation between the visible inclusions, the program often had difficulty counting the cells correctly. We observe the mCherry+ inclusions have more accurate inclusion counts compared to the GFP+ inclusions, with 9/10 of the mCherry+ wells having a percent difference below 5%, while 7/10 of the GFP+ wells had a % difference greater than 10%. This is likely due to mCherry being a brighter fluorophore than GFP resulting in differences in image quality. The amount of noise in the background also negatively impacted the ability of the program to distinguish between inclusions and debris. Furthermore, tightly grouped inclusions can also confuse the program leading to multiple inclusions being counted as one singular entity. Thus, the program functions optimally with high quality images and well-fixed and stained inclusions, which is not always possible.

One way to increase the reliability of the program is to manually count some representative fields and use those fields to create the measurement settings (.iqo file) that can then be applied to batch process the rest of the fields. The variability of staining due to differences in in fluorescence, sample preparation, and the amount of cell debris can influence the resulting image quality and accuracy of automatic counting. Thus, manually counting a field or well to calibrate the initial .iqo file would allow the automatic counting program to become more adaptable and take into account the different qualities of each plate. This would still be much faster than manual counting as this would only require a few wells or fields to be counted. Currently, there is also an effort in improving the IFU assay for greater accuracy in general which will also increase the precision of the automatic counting.

The technique of using Celleste to count inclusions can be expanded beyond just enumerating inclusions in vaccine trials. The EVOS machine also comes with an incubator/time-lapse module so it is possible for the automatic count to be used for real time imaging. Furthermore, it is possible to adapt this beyond just Chlamydia-based uses as the program functions through machine learning applied to differences in colour between the target and the background. Therefore, it is theoretically possible to adapt the measurement .iqo file for any application with strong contrasts between the target and background, such as other immunofluorescence staining.

In summary, we aimed to create an automated count system to batch process image fields in order to expedite the counting of Chlamydia inclusions. In this study we demonstrated that an automatic count provides results comparable to the gold standard of manual counting. This suggests that machine counting could provide an alternative to the labour and time intensive methods of hand counting inclusions and could drastically expedite large scale animal experiments and Chlamydia vaccine development.

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Meet the author:

Shruti is an undergraduate student in the Class of 2024 at UNC Chapel Hill, where she is majoring in Neuroscience and minoring in Medical Anthropology. She is curious about exploring the interplay between mental and physical health, and more specifically, how psychosocial factors shape adolescent girls' experiences with stress. She is also eager to learn about the biological bases of psychiatric disorders, and how the roots of these conditions lie in altered brain anatomy, function, and even genetic mutations. As a research assistant, she hopes to explore mood disorders through a neurobiological lens to understand their underlying causes. In her free time, Shruti enjoys painting, practicing yoga, and hiking with her dog.

Neurophysiological Correlates of Affective State Across the Menstrual Cycle

Shruti Temkar

1. Introduction

The pubertal transition is a unique developmental window characterized by intense hormonal fluctuations, refinement of frontal neural networks, and substantially increased risk of depression in females. Epidemiological data reveals that adult females have 1.5 to 3 times more depressive episodes compared to males. This divergence does not appear until adolescence, implicating ovarian hormone flux in the pathophysiology of depression(Angold & Costello, 2006). Current models of depression, show that it is not a collection of symptoms but rather represents an integrated ensemble of behaviors, perceptions, cognitions, and neurobiological characteristics (a "state"), which reflects the activation or inhibition of specific brain neural networks. Given estrogen's neuroregulatory effects via. neurotransmitter systems, its fluctuations across the menstrual cycle may account for the exacerbated psychiatric illness females experience during puberty (Schiller et al., 2016).

Thus, understanding how biological vulnerability to cycling estrogen levels impact our brains and behavior can help inform targeted intervention strategies for depression in vulnerable populations.

1.1 Estrogen Flux and Affective Dysregulation

During the premenstrual phase of the menstrual cycle, estrogen fluctuates greatly, which can trigger affective dysregulation in susceptible women. Specifically, estrogen withdrawal in the premenstrual phase is responsible for abnormal behavioral states. Schmidt and colleagues found that depressive symptoms recurred in women with a history of perimenopausal depression during estrogen withdrawal, which was exogenously administered in a double-blind, placebo-controlled study (Schmidt et al., 2015). These findings were confirmed by Bloch and colleagues, when women with a history of postpartum depression developed significant mood symptoms during estrogen withdrawal under double-blind conditions (Bloch, 2000). Thus, there is reason to believe that the premenstrual phase produces abnormal affective states due to underlying hormonal milieu. However, empirical data on how affective state changes with estrogen flux during PT is lacking. The PT warrants individual consideration since depressive symptoms manifest uniquely during this time. Namely, depressive symptoms in PT are characterized by irritability, social uncertainty, and peer-rejection sensitivity. (Stringaris et al., 2013)

1.2 Cognitive Dysregulation in Depression

The cognitive model of depression states that emotion processing circuits in the brain are altered such that there is a bias toward negative information. Thus, the experience of negative emotions activates self-critical thoughts, and the inability to disengage from these negative thoughts results in a persistent depressed state (Stringaris et al., 2013). Given estrogen's involvement in cholinergic, noradrenergic, serotonergic, and dopaminergic neurotransmitter systems, it may trigger this faulty "switch" in affective state (Schiller et al., 2016). This heightened attention bias toward negative information and attenuated processing of positive information can be attributed to dysregulation of dorsal and ventral structures in the brain. Greater activity in ventral system structures, responsible for bottom-up (stimulus-driven) processes and reduced activity in dorsal structures, regulating top-down processes, could account for biased processing of negative information (Albert & Newhouse, 2019), (Fales et al., 2008).

Cognitive dysregulation may also arise from the fronto-parietal network, which is responsible for executive control and is diminished in depression. Specifically, the degree of functional coupling between the amygdala and prefrontal regions correlates with trait anxiety levels in adults, such that people with closer coupling have lower trait anxiety, emphasizing how prefrontal-amygdala connectivity impacts mood and emotion regulation (Hare et al., 2008). This is particularly relevant to the PT, where poor prefrontal regulation of hyperactive limbic circuitry creates individual vulnerability to mood disorders (Hare et al., 2008).The default-mode network (DMN), which is dense with estrogen receptors, could be another mechanism through which estrogen alters cognitive control. Responsible for reflective, self-associative thought (ex. judging one's character, focusing on feelings and thoughts), the DMN has been shown to be upregulated in people with Major Depressive Disorder (Schiller et al., 2016). Thus, cognitive dysregulation can give rise to depressive symptoms such as rumination, excessive self-focus, and negative affectivity.

Despite emerging evidence for estrogen's role in cognitive control, no investigations have explored how the brain's electrical activity patterns might play a role. Beta oscillations are responsible for motor function, and modulate top-down activity in learning, novelty detection, sensory gating and reward evaluation (Spitzer & Haegens, 2017). The modulation of cognitive-emotional beta oscillations by the hormonal milieu has not been studied previously and is a key limitation of current literature. Understanding beta oscillatory correlates of cognitive and emotional processing in the context of reproductive hormone fluctuation will provide important insight into the neurophysiological correlates of vulnerable affective circuitry, and how it contributes to the mood disorders during the pubertal transition.

1.3 Present Study

The primary objective of this research is to determine the relationship between irritability symptoms and electrophysiological markers of emotional processing, and whether this relationship is stronger during the premenstrual phase of the menstrual cycle. Here, we use EEG data and self-report questionnaires to address the following aims:

Aim 1: Compare irritability symptoms and affective state in follicular vs. luteal phase of menstrual cycle
According to a 20-year prospective study, irritability is a cardinal symptom of depression in adolescents, and can predict the development of mood and anxiety disorders during adulthood (Stringaris, Cohen, Pine, 2009). Thus, by studying irritability, we hope to gain insight into how mood disorders manifest uniquely during the pubertal transition, and symptoms fluctuate with the menstrual cycle. We predict that the luteal phase, characterized by a sharp decrease in estrogen concentration, gives rise to heightened irritability symptoms.

Aim 2: Compare parietal beta oscillatory activity during implicit viewing task in the follicular vs. luteal phase

We predict that parietal beta event-related desynchronization (ERD), as measured through the Pz electrode, will be higher during the luteal phase in response to fearful faces and lower in response to calm faces. Heightened parietal beta oscillatory activity is corresponded to limbic hyperreactivity to emotional stimuli, causing increased emotional reactivity.

2. Methods

2.1 Participants

22 adolescent females between the ages of 12 and 14 years were selected from a larger, longitudinal study investigating hormonal variability, depression, and puberty. They met Tanner Stage 3 or 4 and were undergoing a natural, healthy pubertal transition. Participants were pre-menarche or within a year post-menarche with cycle irregularity. Participants were screened prior to enrollment for the following the following medical exclusion criteria: a personal history of serious medical illness including epilepsy, or pregnancy (verified with urine screen). Psychopharmacological agents, anticonvulsants, herbal or hormonal supplements were not permitted. Furthermore, participants were excluded if they met the following psychiatric criteria: a history of Axis 1 mood disorders, current suicidal intent, psychotic or bipolar disorders, or active symptoms indicating the need for treatment. At the enrollment session, participants and parents completed online questionnaires to assess pubertal development, demographics and medical history, and current stress and mood. Height and weight were measured to compute BMI. Prior to participation, all subjects provided informed written consent (parental consent and subject assent for adolescents) approved by the Institutional Review Board of UNC- Chapel Hill.

Neurophysiology of Cognitive Control
Eligible participants attended two EEG testing sessions. One session occurred during the participants' late follicular phase, where estrogen flux is low, and the other session occurred in their mid-luteal phase, characterized by high estrogen variability. Menstrual phase was confirmed with home urine LH kits to detect ovulation. The order of which testing session is done first (luteal vs. follicular) was randomized amongst the participant pool. All testing sessions took place at Carolina Crossing in the Psychiatry department in the UNC School of Medicine. Upon arrival, participants were instructed to complete affective questionnaires that measured irritability and depressive symptoms over the past week.

Next, the implicit viewing task was performed using EEG assessment to record the brain's spontaneous electrical activity over a period of time and EEG power reflects the sum of inhibitory and excitatory postsynaptic potentials in thousands of neural columns sampled by an individual electrode. This task has been shown to activate the amygdala more reliably because they are less likely to elicit prefrontal cortex engagement, and potential amygdala inhibition (Leibenluft, 2017).

EEG Recording and Preprocessing
A gtec g. Nautilus EEG cap with 32 electrodes was attached to participant, with Pz electrode as ground and Cz as reference. Data was collected at a sampling rate of 500 Hz. After capping and setup, the participant was asked to attend to a facial feature other than the emotional display. Facial stimuli were selected from the NimStim face stimulus set (www.macbrain.org), depicting happy, fearful, and calm expressions, while participants were asked to assess whether each stimulus had long or short hair. Each stimulus was presented for 500 msec.

Brain vision files were imported, while EEG data was filtered online and referenced to central Pz electrode. All electrical impedances were kept below 10 KW. EEG datasets were down-sampled to 250 Hz and high-pass filtered at 1.0 Hz. Raw data were cleaned, and bad channels were removed using an EEGLAB extension, clean_rawdata. Data was further subjected to manual inspection and rejection of major artifacts before re-referencing the data to average channel values and interpolating bad channels. An adaptive independent component analysis (ICA) was performed to differentiate plausible neural activity, heartbeats, and channel noise. The ICLabel classifier was applied to improve accuracy of computed label estimates and cleaned with ASR (artifact subspace reconstruction) to remove high-variance signal and reconstruct missing data. 2.5 second epochs (−1s-1.5s) were generated for each stimulus type and epochs containing abnormally distributed data were rejected. Increased ERSP relative to baseline reflects event-related synchronization (ERS), whereas deflections in ERSP power are referred to as event-related desynchronization (ERD) (Pfurtscheller, 2001).

2.4 Self-Report Affect Measures
Positive and Negative Affect Schedule. The Positive and Negative Affect Scale for children (PANAS-C) is a 10-item questionnaire that assesses anxiety and depressive symptoms in adolescents. The negative affect subscore (NA) is a broad general factor of emotional distress that includes moods such as fear, sadness, anger, and guilt. Depressed individuals score low on measures of PA, while anxious individuals can score high on PA, as it is characterized by elevated levels of physiological hyperarousal. Both populations tend to score high on NA. Thus, the PANAS is useful for differentiating anxiety from depression in adolescents. Participants are given a word and asked to rate how frequently they have felt this way over the past few weeks. Participants can select from 1 to 5 (1- not at all, 2- a little bit, 3- sometimes, 4- quite a bit, 5- extremely). Words include "sad", "happy, "scared", "miserable", "cheerful", "proud", "afraid", "mad", "joyful", "lively". Scores assessing NA and PA contructs are summed separately, with 5 items each. Questionnaire is administered at the beginning of both EEG lab sessions and assesses participant's affect over the past week.

Brief Irritability Test (BITe) is a five-item scale intended to determine how frequently an individual experiences irritability, separate from related constructs (ex. Depression, anger). Participants are given a statement and asked to rate how well it describes their recent feelings and experiences. Participants can select from 1 to 5 (1- not at all, 2- a little bit, 3- sometimes, 4- quite a bit, 5- extremely). Questions included are "I feel grumpy", "Little things make me mad", "Other people have been getting on my nerves", "Things have been bothering me more than they normally do", and "I felt irritable." This questionnaire is administered at the beginning of both EEG lab sessions and assesses participant's affect over the past week. Inventory of Depression and Anxiety Symptoms (IDAS) (26 items) was used to diagnose participants based on their clinical severity of depressive and anxiety symptoms (Stasik-O'Brien et al., 2019). Participants were asked to rank how well each statement describes their recent feelings and experiences on a 5-point Likert scale, such that (1) = not at all and (5) = extremely. Sample statements include "I felt hopeless or discouraged" and "I had little interest in my usual hobbies or activities."

3. Data Analysis

Statistical analysis was done with SPSS version 28 using Virtual Lab through UNC-Chapel Hill. Differences in group means for PANAS and BITe self-report questionnaires were tested with paired samples t-tests. The significance level was set at P< 0.05.

Beta oscillations within Pz electrode were extracted from complete EEG dataset. P values were obtain Repeated measures (rm) ANOVAS were performed to examine ERD within-group differences in response to fearful stimuli and calm stimuli during the follicular and premenstrual phase.

A Univariate General Linear model was generated to examine interactions and main effects between high depressive risk and low-depressive risk participants, and their affective state throughout the menstrual cycle. A modified screening cutoff score with minimum sensitivity of 0.90 was generated to detect any presence of depressive/anxiety symptoms (Stasik-O'Brien et al., 2019). This separated the cohort into 12 participants with no prior depression and 10 participants with prior depression.

4. Results

4.1 Relationship between Menstrual Phase, Affective State, and Irritability

A paired-samples t-test was conducted to compare positive affect in the follicular and luteal phase. The PA scores for follicular phase (M= 14.32, SD= 4.258) were significantly higher than those obtained in the luteal phase (M= 9.55, SD= 2.890); t (21) = 4.305, p < .001. A similar paired-samples t-test was applied for negative affect from the PANAS scale. NA scores were significantly higher in the follicular phase (M= 5.68, SD= 1.427) compared to the luteal phase (M= 13.27, SD= 3.383); t (21) = -9.338, p < .001.

Irritability across the menstrual cycle was analyzed from the BITe scale using similar methodology. BITe scores were significantly higher in the follicular phase (M= 1.990, SD= 0.5129) compared to the luteal phase (M= 1.680, SD= 0.4830); t (20) = 2.493, p = .022. One participant was excluded in the follicular phase (EV233) and luteal phase (EV246) dataset due to incomplete responses.

4.2 Relationship between ERSP, Valence, and Phase

Significant p-values were obtained during the full range of beta frequencies (12-30 Hz) from 600 to 800 ms post-stimulus, as indicated by Figure 1. Beta event-related desynchronization (ERD) in response to fear stimuli was greater during the luteal phase (F(1,21)=8.416, p=.009, np2=.286). There was not a main effect of valence (calm vs fear), but the phase by valence interaction was marginally significant (F(1,21)=4.073, p=0.057, np2=.162, indicating that beta ERD was reduced for calm stimuli during the luteal phase.

4.3 Reexamination of Initial Diagnostic Depressive Scores

Descriptive statistics for IDAS sum scores at the enrollment session were obtained, demonstrating a large range. (M= 59.7, SD= 11.54, Min: 45, Max= 80). Most participants exhibited mild symptoms of depression, however the severity ranges from no depression to moderate depression. No significant correlation was observed between ERSP values at the follicular and luteal labs and IDAS sum scores.
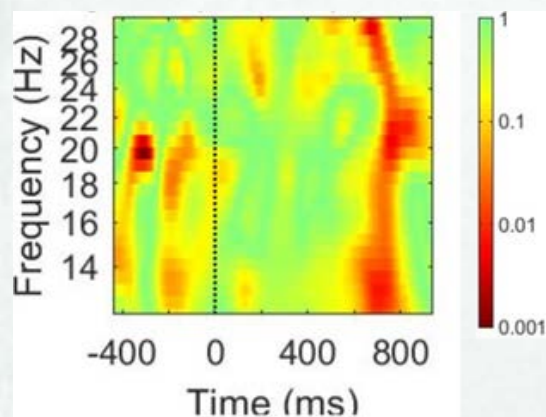
Figure 1. Topographical plot depicting time ranges and beta frequency ranges with the greater significance (p-values).
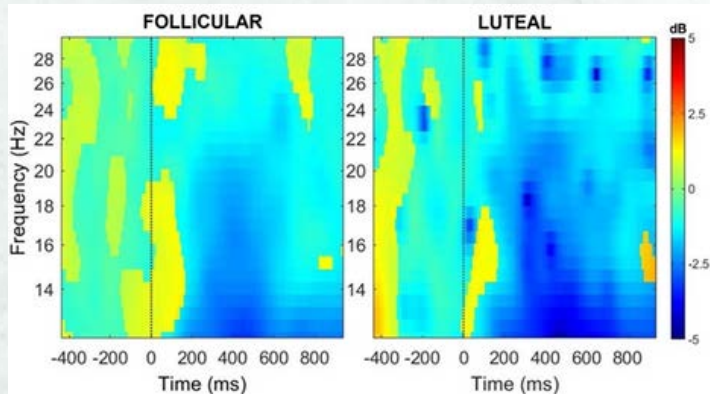
Figure 2. Time-frequency spectrograms depict average parietal beta (12-30 Hz) ERSP (event-related spectral perturbation, dB) for fearful stimuli during the follicular and luteal phase. During the late window (600 – 900ms).
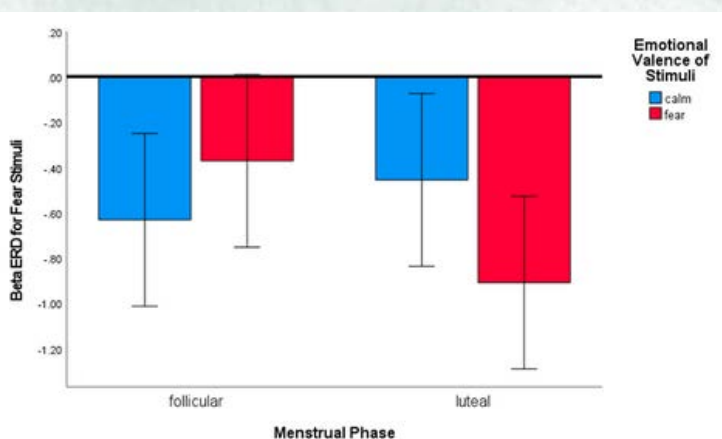
Figure 3. A Univariate General Linear model for ERSP values comparing valence of emotional stimuli across the menstrual phase. Error bars are depicted with a 95% confidence interval.

5. Discussion

The objective of the present study was to examine changes in limbic affective circuitry as potential mechanisms underlying the estrogen-mood relationship during the pubertal transition. Using a multimodal approach, we found that the premenstrual phase predicted increased event-related desynchronization (ERD) towards fearful stimuli and decreased ERD towards calm stimuli. This is indicative of limbic, particularly, amygdala hyperreactivity to fearful stimuli during the luteal phase, causing heightened threat reactivity. Cognitive dysregulation of threat reactivity also coincides with greater negative affect and lower positive affect during the luteal phase. Specifically, this study confirms that estrogen withdrawal, characteristic of the premenstrual phase, correlates with increased negative affective state, thus, supporting our hypothesis. Interestingly, irritability was higher in the follicular phase compared to the The objective of the present study was to examine changes in limbic affective circuitry as potential mechanisms underlying the estrogen-mood relationship during the pubertal transition. Using a multimodal approach, we found that the premenstrual phase predicted increased event-related desynchronization (ERD) towards fearful stimuli and decreased ERD towards calm stimuli. This is indicative of limbic, particularly, amygdala hyperreactivity to fearful stimuli during the luteal phase, causing heightened threat reactivity. Cognitive dysregulation of threat reactivity also coincides with greater negative affect and lower positive affect during the luteal phase. Specifically, this study confirms that estrogen withdrawal, characteristic of the premenstrual phase, correlates with increased negative affective state, thus, supporting our hypothesis. Interestingly, irritability was higher in the follicular phase compared to the premenstrual phase, counter to our proposed hypothesis. This could be due to the misalignment of lab sessions with participants'

menstrual phase, and other confounding variables, such as a small sample size (n=22). Future studies should look at the weekly mood reports alongside those already administered at lab sessions to track overall trends in mood throughout the month, rather than at just 2 time points. Future studies could also assess other neurophysiological correlates of cognitive control, namely the theta-beta ratio in frontal and parietal lobes to detect top-down control and functional coupling between limbic structures and the prefrontal cortex. We found no significant impacts of CONQUERing on stress reduction or on attentional focus. This was especially surprising for two reasons. First, one might hypothesize that changes in self-reported stress would mirror changes in self-reported anxiety. Moreover, most of the previous literature focuses on the potential impacts of fidget devices on attention and concentration. Perhaps the benefits of fidget device use that have been found with regard to performance are associated with calming the nervous system rather than increasing attentional control.

An important strength of the present study is that it was designed as a randomized controlled trial (RCT). The strength of the RCT design is that it allows researchers to elucidate whether the effects of the intervention are due to the specific nature of the intervention over and above non-specific factors present in all interventions. Examples of non-specific factors include; being part of a research study, expectations of change, and repeated assessment. In the present study, the only difference between groups was that the experimental group wore the CONQUERing, accordingly we can conclude that wearing a CONQUERing had a causal effect on anxiety reduction.

6. Conclusion

The present study proves that affective state changes across the menstrual cycle, implicating the role of hormones in mood and behavior. The luteal phase, a period of high estrogen flux, is associated with heightened threat reactivity and dysregulated cognitive control, which precipitates increased negative affect. By acting through receptors located in key regulatory limbic regions (ex: amygdala, hypothalamus) (Schiller et al., 2016), estrogen may influence the refinement of frontal-limbic connectivity and associated emotional processing during the pubertal transition, a period of reproductive endocrine instability (Angold et al., 1999).

Ultimately, this research provides insight into the neurophysiological correlates of vulnerable affective circuitry, and how it contributes to the psychopathology during the pubertal transition.

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Social Sciences

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Levels of Democratic Consolidation in Venezuela and Chile: An Analysis of Economic and Political Processes
Eleanor Rankin

Democratic consolidation is linked to lower levels of poverty, inequality, and mortality rates, yet there remain many obstacles to such developments in many Latin American countries. Latin America has seen radically different levels of democratic consolidation throughout the 1980s into the 21st century, and an important question remains: how did certain countries achieve democratic consolidation while others did not? This paper explores the linkage between economic and political processes in Latin America, and how those patterns cause the differing outcomes of democratic consolidation. Specifically, the paper addresses why Venezuela experienced democratic backsliding while Chile has been able to consolidate its democracy. In the latter 1980s, Venezuela had higher levels of democracy than Chile, however, presently Venezuela is in collapse and Chile has stronger democratic intuitions. During re-democratization, the differences in the two countries' economic policies on copper and oil, and strength of their political parties has led to two different outcomes: consolidation of democracy in Chile and democratic backsliding in Venezuela. I will analyze the political processes in these countries between the years of re-democratization in 1980s to present day.

Historical Background

At the end of the Cold War, Venezuela was one of the only Latin American countries to maintain democratic principles, followed by economic growth throughout the 1980s. Jason Seawright claims, "before the 1990s, Venezuela's two-party system was among the most stable and well-institutionalized party systems in the developing world" (1).

This party system strength lasted through 1988 with fully democratic, regular, multi-party national elections. However, in 1993, Venezuela saw democratic backsliding resulting in a lack of endorsement by either party for the president (Seawright). On the other hand, Chile had relatively strong parties and fairly stable politics from 1930-1970.

During the 1950s, Chile's three-party system faced the emergence of a third partisan group, Christian democrats. This resulted in polarization into distinct groups with a third right, third center (Christian democrats), and a third left (Allende), each of which contained roughly equal popularity.

From 1970- 1973, Chile experienced full democracy with elites rallying behind the center government and Allende's goal of a democratic transition to a socialist economy dominating the political sphere (Huber). The collapse of Allende's reforms and civil unrest laid the context for the overthrow by Augusto Pinochet's authoritarian regime in 1973. Chile suffered a brutal, repressive bureaucratic authoritarian regime and decades of punishing austerity. Pinochet implemented neoliberal policies such as privatization of copper, cut foreign exchange controls, and gutted social expenditures. These policies generated unprecedented levels of social unrest and protests in the latter 1980s because "in a country like Chile, with almost no unemployment compensation benefits, the social impact of high and persistent unemployment has been devastating" (Cortázar).

Chile's government during re-democratization remained ridden with military enclaves, leading to protests over the stratification of education and inadequate welfare programs in the early 21st century. Both Venezuela and Chile suffered the booms and busts of economic cycles amidst a debt-crisis throughout the 1980s and 90s and had different individual policy responses. Why in the 21st century has Chile been able to consolidate democratic principles while Venezuela has experienced democratic backsliding? The countries are similar in many ways, yet they have such different outcomes. Specifically, their democratic prospects have almost swapped during re-democratization.

To lay the context for my argument, I will first show evidence that Chile did in fact experience democratic consolidation, and Venezuela experienced democratic backsliding. When a country has a consolidated democracy, these democratic institutions are able to protect civil liberties and political rights. However, when a country experiences backsliding into autocratic behavior, rights and liberties are more restricted (seen in the figures below). Since 1990, Chile has had a steady trend towards protecting civil liberties and political rights, while Venezuela has seen increasingly restrictive policies. The level of restrictions on civil liberties and political rights reflects a country's consolidation of democracy, where high consolidation offers protections and backsliding generates restrictions.

Therefore, providing context for my argument, this data shows there is indeed democratic consolidation in Chile and backsliding in Venezuela. What economic and political factors led to this divergence of democratic processes?

Figure 7. Restrictions on Civil Liberties in Venezuela and Latin America (Freedom House)

Figure 6. Restrictions on Political Rigths in Venezuela and Latin America (Freedom House)

Figure 2. Restrictions on Civil Liberties in Chile and Latin America (Freedom House)

Figure 3. Restrictions on Political Rights in Chile and Latin America (Freedom House)

SOURCE: (NAVIA) FREEDOM HOUSE

Analysis of Economic Processes:

Economics are linked with politics in the causation of the different outcomes of democratic consolidation in Venezuela and Chile. While both countries relyon natural resources- Chile with copper and Venezuela with oil- the economic policies of their respective governments influence differing levels of democratic consolidation. Copper in Chile and oil in Venezuela establish a large portion of their respective fiscal revenues, national income, and economic strength. With oil being 95% of Venezuelan exports and 25% of its GDP whilecopper being 28% of Chile's exports 11% of its GDP, global prices of these two natural resources can have dramatically positive or negative effects on their respective economies (DePersio). While Chile and Venezuela both rely on natural resources, their economic policies differ on how to use such revenues, having an effect on the relative strength of their economies. In this section, I will discuss Chile and Venezuela's relative GDP growth, balance of payments, and investment in social programs as it relates to their natural resource economics and consequences of such policies.

Beginning with Venezuela, economic policy surrounding the oil sector included nationalization, spending of oil rents, and lack of macroeconomic stabilization. Essentially, the economic policy in Venezuela made its economy vulnerable to the booms and busts of global oil prices. Venezuelan oil nationalization in 1976 under Present Carlos Andres Perez spurred state-led growth of the economy, with the Petroleos de Venezuela. As expected, when oil prices fell in the 1980s, Perez was forced to implement austerity measures including privatization of oil

production, cuts in government expenditures, increase in foreign investment, and consequently unemployment and poverty rose.

Without an existing reserve fund or a functioning income tax system, enormous civil unrest broke out in Venezuela. Amidst the debt crises and pressures from the International Monetary Fund, Perez had little economic capacity. Hugo Chavez staged a failed coup in 1992, yet later was elected as a socialist president in 1998. Following a union strike from oil company workers in 2002-2003, Chavez replaced thousands of Petroleos de Venezuela workers, effectively hindering the growth of oil in Venezuela (Cheatham). Additionally, the coup made Chavez more stringent on anti-U.S and anti-business rhetoric. Chavez's additional economic policy was to subsidize oil in aid to other countries, such as in exchange for Cuban doctors (Huber). The economic policies of Venezuela surrounding oil both before and during the administration of Hugo Chavez is a reason why Venezuela has experienced democratic sliding. When oil prices fell yet again in 2014, Nicolas Maduro consolidated his administration's power amidst economic collapse by reeling in democratic practices and dishing out autocratic behaviors (Cheatham).

Contrastingly, Chile during the post-authoritarian Pinochet regime (starting around 1984) with the administrations of Aylwin, Frei, Lagos, and Bachelet, greatly expanded economic growth and focused on poverty alleviation reforms (Navia). Distinctive from Venezuela (particularly Chavez's use of oil rents), Chile had a different economic policy regarding its natural resource revenues. In 1987, Chile established the Copper Stabilization Fund (CSF) as macroeconomic stabilization policy. Essentially, the copper reservation fund accrued funds when copper prices were high which served to stabilize the economy and prevent downturn or collapse when copper prices were low.

According to Solimano and Guajardo, the copper fund was a pivotal economic policy. As noted in Addison et al., "the revenues from the copper sector are a main source of fiscal revenues" which helps,

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"ensure a more stable stream of revenues for the state and, in principle, avoid cycles of expansion and contraction in public expenditure" (pg. 201 [Addison] Solimano and Guajardo). These reforms spurred a steady increase in gross domestic product (specifically in the 1990s), enabling the promotion and continuation of democratic administrations in Chile.

The different economic outcomes as a consequence of the two countries distinctive economic policies surrounding copper and oil can be analyzed through the gross domestic

product annual growth per capita:

stabilized the balance of foreign transactions. In the first balance of payments graph below, Chile had a relatively stable exchange during re-democratization, while the second graph features a clear demonstration of how Venezuela's economic policies resulted in a volatile exchange.

The spikes seen in both countries around 2005 can be attributed to commodity booms. However, the key factor here is the difference in economic policy creating a stronger economy in Chile and a weaker economy in Venezuela.

While both Venezuela and Chile had consistent social expenditures, Chile's programs were specifically focused on poverty reduction and alleviation, while Venezuela's were top-down approach programs. Hugo Chavez as a socialist administration created supply stores that directly supplemented the middle and lower classes with cheap goods, but this resulted in black markets and an imbalance between a high demand for food and a low incentive for suppliers to produce. Rather than effectively alleviating poverty, social spending in Venezuela resulted in class tensions (Huber).

Both Venezuela and Chile are subject to the volatile world market prices for oil and copper. The difference in how the two countries handled the cycle of booms and busts lies in their economic policy. Venezuela lacked macroeconomic stabilization policies that Chile had put in place in the late 1980s, which enabled their economic expansion through the 1990s. The economics policies of Chile, specifically a market-friendly trade model and a copper reserve fund, allowed for the gradual increase in gross domestic product, and alleviated both the debt crises and balance of payments crisis. Not only did these policies lead to a stronger economy, but adequately alleviated poverty and enabled investment in human capital through education and health care. Furthermore, the economic development experienced by Chile, coupled with political factors, led to democratic consolidation. The alleviation of poverty and adequate social spending provided favorable conditions for Chile's democracy to consolidate. The transition from authoritarian rule to the restoration of democracy beginning in the 1990s would have been impossible without stable macroeconomics.

Figure 11. GDP per capita in Venezuela and Chile, 1980-2009
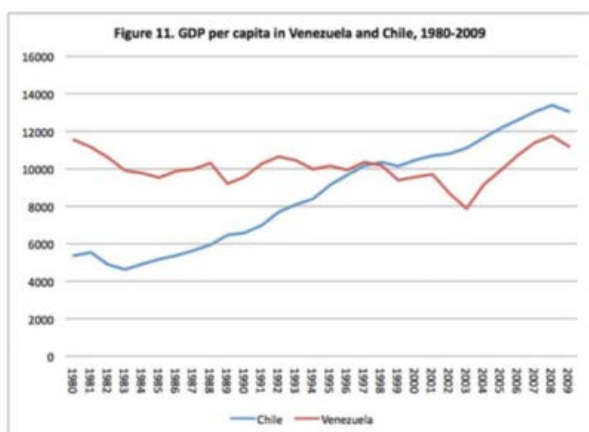
Source: (Navia) World Development Indicators, World Bank. GDP per capita PPP. Furthermore, Chile's copper reservation fund was reformed into a new system in 2006 called the Economic and Social Stabilization Fund (ESSF). The country's continued stabilization of copper as a natural resource is further seen in their balance of payments compared to Venezuela, which harnessed a reserve fund during times where copper prices declined and

Venezuela, on the other hand, began to see democratic backsliding as leaders such as Chavez and Maduro retired democratic values for authoritarian control amidst a crippling economy.

Analysis of Political Processes:

In addition to economic policies, political reasoning is a cause for differing levels of democratic consolidation among states in Latin America. Political parties are an essential mechanism of healthy democracies. They serve as a vital link between people and their government, and facilitates representation and communication between the two agents. A strong party system ensures that political actors are habituated to a democratic government, leaving little room for actors to revert to autocratic schemes. The "rule of law" is supported by political parties, active engagement by the parties, the government, and the people facilitating democratic consolidation. Party strength is an important causal factor to the degree of democratic consolidation in a given country. Therefore, when looking at specific countries, significant changes in their party systems' strength can have either detrimental or beneficial effects on their democracies. While Chile experienced strong political parties, contributing to the consolidation of its democracy, Venezuela experienced party system collapse leading to democratic backsliding, which was evidently exacerbated by Hugo Chavez. Political parties in Venezuela essentially collapsed before Hugo Chavez came to power; Chavez filled the political vacuum left by the loss of support of the traditional parties. Chavez further undermined the legitimacy of parties (other than his own) and of democratic institutions (Huber).

To understand the political factors that led to democratic backsliding in Venezuela, it is important to preface by portraying the significant effects of party collapse on a country's whole political system.

Party system collapse on the surface-level creates a problematic political sphere, but also generates acute conflict, class tensions, economic grievances, and usually a power vacuum (Morgan). Before the 1980s, Venezuela was seen as a "democratic success" while in the 1980s, Venezuela experienced weakening parties which resulted in an eventual collapse of the party system, followed by Chavez filling the power vacuum (Huber). The combination of party system disintegration and the further democratic erosion by Chavez led to democratic backsliding in Venezuela. Venezuela's party system collapsed due to a right shift of a historically left AD party, corruption of left parties, and failure of left parties to garner support amidst an economic crisis (Mainwaring and Morgan). Against the backdrop of a sweeping debt-crisis among Latin American countries, Venezuela re-elected Carlos Andres Perez in 1989 from the Democratic Action party. With this re-election came a variety of neoliberal economic reforms including privatization of Venezuela's oil industry, trade liberalization, and deregulation. When political parties stray from the interests of its constituents, citizens turn to another option. With Perez and the Democratic Action party, the liberalization of petroleum prices increased the cost of transportation in major cities, leading to protests and civil unrest (Wikipedia). These protests "furnished a stunning, public display of festering frustration with the traditional parties" (Morgan). Perez was impeached for corruption and removed from office in 1993. Even with the Democratic Action party fundamentally weakened, the traditional left parties were unable to garner significant support from Venezuelans.

COPEI was not considered a viable substitute to AD, since the party continued to similarly bring neoliberal policies to the table. The two parties neglected to integrate the growing urban poor and informal sectors including labor unions into their parties- leaving significant swaths of the Venezuelan population detached from the parties. Furthermore, despite the lack of inclusion, the parties' interest in neoliberal reforms due to their involvement in the Washington Consensus left those sectors feeling unrepresented and seeking alternatives to the two-party system. While the two-party system weakened during the 1980s into the 1990s, the party system officially collapsed in 1998 with the election of Hugo Chavez. Morgan states, "by 2003, fewer than 15% of Venezuelans identified with COPEI or AD" (82). The partisanship data below of Venezuela from 1973-2003 is evidence of this argument:'

The consequence of weak parties and potential system collapse in Venezuela is democratic backsliding. Parties are unable to turn basic needs into political demands or effectively push through legislation. Venezuela experienced additional erosion of political inclusivity and institutions due to a populist leader. Hugo Chavez filled the power vacuum and enacted authoritarian policies such as a unicameral congress, reducing the power of local authorities, concentrating power, gerrymanders, and general corruption. Carías argues, "the first step to subvert democratic principles and values materialized in 1999 with the forced convening of a constituent assembly" (1). The context of party system collapse allowed Chavez to enact these autocratic reforms to the Chilean constitution, effectively backsliding the Chilean democracy into authoritarianism (Carías).

Contrastingly, Chile during re-democratization had a party system that included: coalition-forming, multiparty national elections, and internal cohesion. These factors all contributed to democratic consolidation in Chile. Post-Pinochet in 1989, Chile transitioned to a full democracy consisting of a two multi-party coalition system led by the Concertación, an alliance of center and left parties (Espindola):v14

Chile's party system (seen in the graph above) allowed coalitions to form that cooperated on congressional agreements and implemented policy in that manner. The Concertación governments: Aylwin (1990–1993), Frei (1993–1999), Lagos (2000–2006), and Bachelet (2006– 2010), although gradually declining in support after 2000, maintained a stable political sphere (Mella-Polanco). Chile experienced strong economic growth, and alleviated poverty levels. The Concertación was strong because it appealed to the popular anti-right sentiment post-Pinochet, and spearheaded economic growth. Chile has institutional constraints that, unlike the Venezuelan case, forced presidents to be dependent on coalition groups for support (Huber and Stephens pg. 206). Second, the consistency of multiparty national elections shown in the data below is evidence of party strength in Chile:
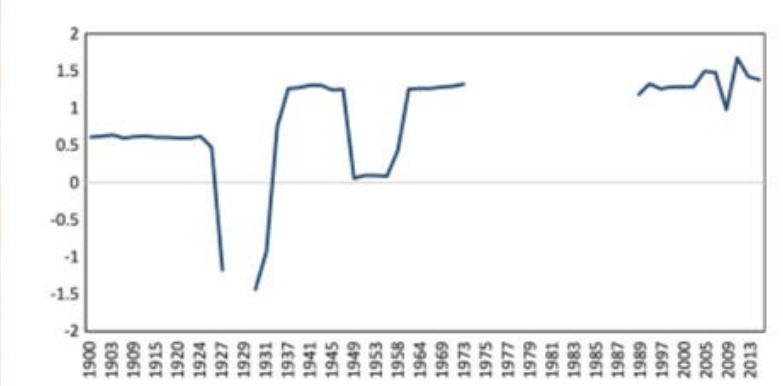
Graph 3: (Mella-Polanco) Multiparty national elections 1900-2013.

CHILE: PARLIAMENTARY SEATS ELECTED IN 1997 AND 2001

	1997		2001	
	Deputies	Senate	Deputies	Senate
Concertación	70	20	62	20
PDC	38	14	24	12
PPD	16	2	21	3
PRSD	5	0	6	0
PS	11	4	11	5
Alianza/Unión	44	14	57	16
RN	22	6	35	7
UDI	22	8	22	9
PC/The Left	0	0	0	0
Humanists	0	0	0	0
Union Centro*	1	1	–	–
Independents	5	3	1	2

* In 2001, the Union de Centro-Centro did not stand.
Source: Servico Electoral. Chile. 2001.

GRAPH 2: (ESPINDOLA)

Graph 3 indicates multiparty national elections, where after 1989 (re-democratization after Pinochet), multiparty elections were consistent, indicating a strong, healthy party system in Chile. Strong party systems capable of engaging in multiparty national elections contributed to democratic consolidation in Chile from 1980-2013. Another relevant trend during the re-democratization period was patterns of growing legislative cohesion:
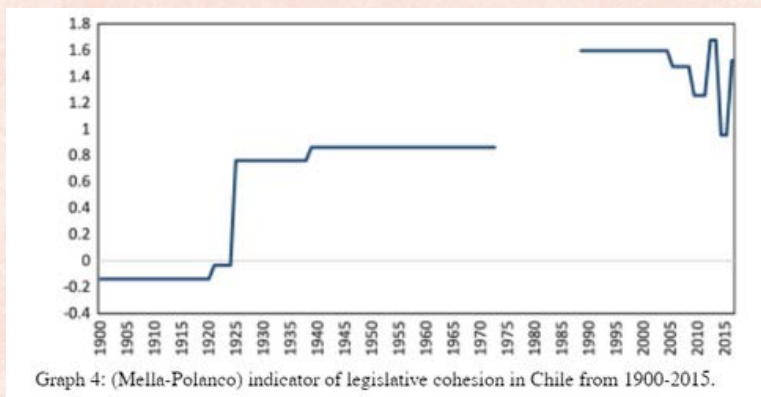
Graph 4: (Mella-Polanco) indicator of legislative cohesion in Chile from 1900-2015.

Chile's party system, most similar to Europe's, was the most governable because of its consistent coalition-forming, participation in multiparty elections, and internal cohesion. This 16 allowed democratic participation, legislative advancement, and a stable political atmosphere. It is important to note that Chile, although extensive efforts have been made to alleviate poverty, inequality has not been adequately alleviated. In 2019, protests broke out over the stratification of education, and outdated frameworks of Pinochet left in place by Concertación governments. The future of democracy in Chile rests in its ability to maintain programmatic rather than clientelistic policies and sustain the connection between the people and parties despite fragmentation (Huber).

Conclusion:

The differences in political and economic processes since 1989 has led Chile towards democratic consolidation and Venezuela towards democratic backsliding. First, while Chile's reserve funds of copper have softened the busts of price volatility, Venezuela especially under Hugo Chavez has neglected to implement similar economic policies, spiraling the Venezuelan economy into collapse when oil prices are low. These economic differences serve as a cause for democratic consolidation in Chile as it allows its democracy to freely thrive, while Venezuela's economic collapse has forced Chavez to use autocratic tactics to consolidate control amidst social unrest. Second, while Chile's party system thrives with multiparty national elections, internal cohesion, and coalitions, Venezuela's party system has faced weakening and even collapse. Since party systems support democratic institutions and democratic participation in the population, Venezuela has experienced democratic backsliding and Chile has experienced democratic consolidation. The combination of these economic and political processes serve to explain the divergent paths of Venezuela and Chile's level of democratic consolidation from the 1980s to present day.

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Lessons From Differing State Recreational Marijuana Policies
John Macejka

 Currently, 19 states and Washington D.C. allow the distribution, possession, consumption, and taxation of recreational marijuana. Located in every region outside the southeast, these states offer unique opportunities to evaluate the factors that drive certain states, and not others, to consider and eventually legalize marijuana. By systematically comparing states along a variety of dimensions, this paper pinpoints which state features and dynamics explain differential recreational legalization outcomes across US states.

   Organizationally, this paper first considers regional trends in marijuana policy, specifically contrasting western and northeastern states to their southeastern counterparts, to evaluate the influence of interstate diffusion, political culture, and direct democracy on marijuana legalization outcomes. After highlighting influential regional particularities, I consult public opinion data and pertinent literature to correlate aspects of individual identity to support for recreational marijuana legalization, before arguing that the relative predominance of these groups in certain states contributes to divergent legalization results. To supplement these conclusions, this paper finally evaluates California's unprecedented and lengthy movement towards recreational legalization. By focusing on changing dynamics between the unsuccessful first recreational legalization initiative (2010) and later successful initiative (2016), this case study illuminates how shifting public opinion, proximate states' legalization, changing governors, and campaign finance influence states' recreational marijuana policies.

Regional Trends: Diffusion, Political Culture, and Direct Democracy
 Figure 1 illustrates the importance of geography in predicting states' marijuana policies. As seen below, western and northeast states feature near ubiquitous legalization while - remarkably - the southeastern United States lacks any states where cannabis is recreationally legal. Given the regional clustering of legalizations, three potentially intertwined explanations, which illuminate factors driving differential legislative outcomes, deserve consideration: interstate diffusion, regional political culture, and the presence of direct democracy.

Figure 1

Recreational marijuana laws by state

As of July 2022, recreational marijuana was legal in 19 states. This chart shows the method by which each state legalized marijuana.

Illegal Legalized (Measure) Legalized (Bill)

Last updated: July 2022
Map: Ballotpedia • Source: National Conference of State Legislatures

BALLOTPEDIA
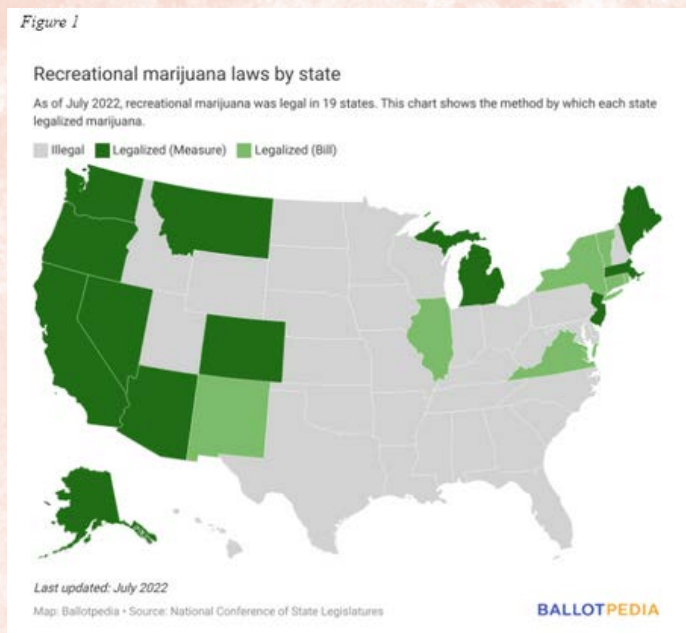
Interstate diffusion represents a well-studied explanation for why recreationally legal states cluster together geographically. To demonstrate, 15 out of 20 recreationally legal states/districts (including Washington D.C.) directly border another recreationally legal state, hinting at a pattern of regional diffusion. Conceptually, this diffusion makes pragmatic sense; marijuana legalization represents a complex issue whose potentially controversial and detrimental implications plausibly prevent both citizens and lawmakers from risking societally and electorally damaging po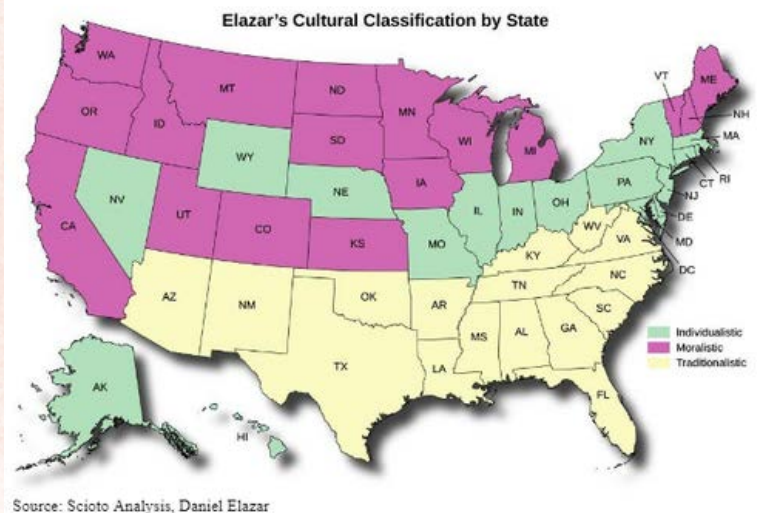licy experimentation. As such, states first analyze the consequences of recreationally legalizing marijuana in proximate - and frequently similar - states before replicating successful models. Bradford and Bradford find statistical evidence to support this conclusion, demonstrating that when neighboring states legalize medical marijuana other states are more likely to follow suit. While this study concerns medical marijuana, subsequent research by Valente affirms its relevance to recreational legalization and decriminalization. Thus, policy diffusion partially explains both why certain states recreationally legalize marijuana and why these states are geographically proximate.

Equally important to understanding the geographic clustering of recreationally legal states is states' political culture, which illuminates the absence of recreational legalization in any southeastern states. Consulting Elazar's seminal framework in Figure 2, 17 out of 20 recreationally legal states/districts feature either individualistic or moralistic political cultures, which implies greater potential for policy change motivated by popular opinion. Moreover, for the only three traditionalistic states featuring recreational legalization, each directly and exclusively borders a region of alternative political cultures. Returning to the influence of political culture in determining legalization outcomes, states with a traditionalistic political culture generally prefer to maintain the status quo, minimizing citizen participation in government and crucially not introducing forms of direct democracy, notably the initiative.

Therefore, the predominance of traditionalistic political culture in the southeast seems an intuitive explanation for the startling absence of recreational legalization in this region, whereas the more individualistic and moralistic cultures of the northeast and west readily allow or enable political/social change.

Figure 2

Elazar's Cultural Classification by State

Individualistic
Moralistic
Traditionalistic

Source: Scioto Analysis, Daniel Elazar

Reflecting back on Figure 1, an equally important predictor for state marijuana policy emerges: whether a state features forms of direct democracy - most importantly, the ballot initiative. The ballot initiative allows citizens or groups to put proposed laws onto the ballot for voter consideration, thereby circumventing the typical legislative process. Of the 20 states/districts to legalize recreational marijuana, 13 (65%) did so via the initiative process. Intuitively, given that 68% of the US public support cannabis legalization, the initiative remains an extremely important factor in determining whether states might recreationally legalize marijuana. Less obvious and unseen in Figure 1, the first 9 states to legalize recreational marijuana did so via the initiative - not until 2018 did a state (Vermont) legalize via legislation. Herein exists important evidence supporting an argument posited earlier in this paper: because of the potential and unknown detriments legalization might involve, legislatures wait for evidence of successful recreational legalization achieved via direct democracy before proposing legislation.

Consequently, states lacking the initiative but neighboring states featuring direct democracy might experience increased chances for recreational legalization, given individual legislature's increased knowledge relating to the consequences of marijuana legalization. Importantly, evidence since 2018 supports this notion, as 7 out of 10 (70%) of newly recreationally legal states did so via legislative action, with each, excluding Illinois, directly touching a state that previously legalized recreational marijuana via the initiative. Thus, the initiative dually explains recreational legalization. On the one hand, the initiative allows public opinion to manifest in legislative change (which explains the first round of legalizations). And on the other, states who legalized via the initiative demonstrate the policy consequences and electoral implications to legislatures, thereby reducing the risk of legislative action in nearby states (which explains why states bordering initiative states legalize). In both cases, the initiative supports recreational legalization. Conceptualizing interstate diffusion, differing state political cultures, and direct democracy together partially explains why western and northeastern states disproportionately feature recreational legalization compared to southeast states. Partly because southern states feature predominantly traditionalistic political cultures, these states rarely allow direct democracy. Consequently, even if public opinion supports legalization, legislatures must proactively legalize recreational cannabis. But, as demonstrated previously, legislatures consistently wait to legalize recreational marijuana to observe potential consequences in proximatestates. Because southeastern states' traditionalistic political cultures implicate the absence of direct democracy, legislatures never observe the potential consequences of recreational legalization without assuming the electoral risk of legislative action. In the South, the absence of recreationally legal model states prevents the diffusion of marijuana policy across the US southeast.

Marijuana Usage and State Demographics: Age, Gender, Religion, and Partisanship

Complimenting this regional approach, state population demographics and features, specifically relating to population marijuana usage, age, gender, religious affiliations, and partisanship, illuminate why certain states, regardless of region, support recreational marijuana legalization. I argue that population policy preferences, partially dependent on the above factors, either directly underlies initiative success, leads to the election of pro-legalization representatives, or pressures legislatures to favor legalization legislation – all of which contribute to differential state legalization outcomes. Unfortunately, the absence of state-specific demographic and political data inhibits the direct statistical correlation of these factors to legalization outcomes. However, logical deduction utilizing public opinion and marijuana usage data nevertheless offers unique insight into the importance of state specific demographic factors in dictating recreational marijuana policy.

First and foremost, high levels of population marijuana usage should correlate to increased support for recreational marijuana legalization. Intuitively, marijuana users possess incentive to support recreational legalization because legalization eliminates the legal risk or personal cost of cannabis consumption. Since cannabis consumers possess firsthand experience of consumption's consequences yet continue to use the drug, these individuals plausibly support recreational legalization ideologically, beyond the immediate reduction in personal risk associated with recreational legalization.
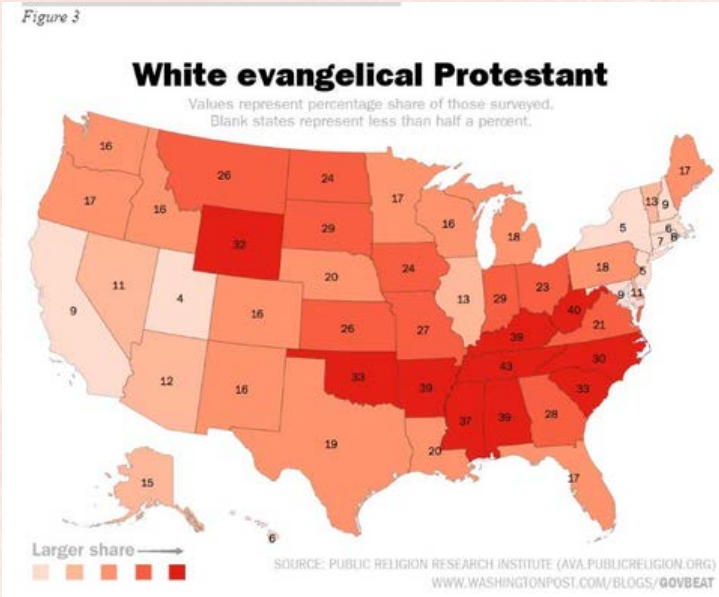
With perfect data, states with the highest levels of marijuana usage should reflectively feature recreational marijuana legalization while bearing in mind regional dynamics. However, the unavailability of this information prevents an affirmation of this conclusion, hence the necessity of considering proxy factors.

Luckily, pertinent literature finds that certain population groups in the United States disproportionately consume cannabis, suggesting that recreational legalization should follow where these groups predominate. Beginning with age, 30% of young adults (18-34) consume cannabis compared to only 7% of older adults (55+). Tentatively supporting the hypothesis that usage correlates to support, PEW Research finds the greatest support for legalization amongst individuals aged 18-29, with each subsequent (older) age groups' support decreasing. Importantly, the only age group not to support recreational marijuana (adults 75+) was observed to be the least likely age group to smoke. Such logic corroborates earlier work by Galston and Dione, which highlights age as a crucial variable in determining legalization attitudes, correlating younger individuals to increased support and old age (65+) to decreased support.

Gender also offers insight into usage rates and recreational legalization support, with women consistently reporting lower marijuana consumption than their male counterparts. Reflecting marijuana usage trends, women consistently report lower support for recreational marijuana compared to men. A Washington Post analysis found that "what best explains the gender gap in marijuana attitudes is the gender gap in marijuana use." Simply put, marijuana usage amongst certain population groups correlates to those groups' supporting recreational legalization.

Considering these factors, states with a large population of young males should feature recreational marijuana legalization more frequently than older, female-dominated states.

Perhaps the most important determining factor of individual marijuana consumption and attitudes is religion. If certain religions correspond to reduced consumption and/or to lower support for recreational legalization, the states where these groups predominate should reflectively lack recreationally legal cannabis. Religiously unaffiliated adults demonstrate higher levels of support for recreational marijuana legalization than religiously affiliated adults, with the difference increasing as the salience of religion and frequency of church attendance rises (i.e. more religious involvement/belief leads to lower support for recreational marijuana). The difference is most pronounced amongst white Evangelicals, who are the only religious population where a majority (>50%) opposes medical and recreational legalization. As such, states with disproportionately religious populations, specifically white evangelicals, should lack recreational marijuana, especially compared to non-religious states.

Figure 3

White evangelical Protestant

Values represent percentage share of those surveyed.
Blank states represent less than half a percent.

Larger share ⟶

SOURCE: PUBLIC RELIGION RESEARCH INSTITUTE (AVA.PUBLICRELIGION.ORG)
WWW.WASHINGTONPOST.COM/BLOGS/GOVBEAT

Fortunately, Spetz and coauthors groundbreaking work and Figure 3 present direct empirical support for the drastic influence a state's religious composition has in dictating recreational marijuana policy. Comparing differing states across nearly a decade, Spetz and coauthors correlate states' economic, political, social, geographic, and demographic characteristics to illuminate factors influencing cannabis decriminalization and legalization. Through statistical analysis, these authors found Evangelical Protestants rarely appeared in recreationally legal states and frequently appeared in illegal states, regardless of region. Especially predominant in Wyoming and the US southeast, the dark red states in Figure 3 (possessing the highest proportion of White evangelical residents) ubiquitously lacked recreational legalization (compare to Figure 1), further affirming the correlation between certain types of religion and state recreational marijuana legalization.

Another important determinant of individuals' marijuana usage and attitudes is political ideology, often expressed through partisanship. Denham (2019) discovered that personal political ideology functions as a significant explanatory variable in determining support for recreational legalization, with Democrats exhibiting more support than Republicans. However, seemingly contradicting this literature, Galston and Dione find increasing support for recreational legalization amongst Republicans since 2010, suggesting attitude convergence regardless of party (although the differential in support remains approximately 10%). This relative absence of issue polarization or politicization suggests an important conclusion relating to Grumbach (2018): since non-polarized issues tend to exhibit substantially less policy divergence across states, marijuana must either represents an exception to this trend or a policy convergence in recreational legalization should manifest over the coming years.

Regardless, Democrats continue to disproportionately support recreational marijuana. States where Democrats predominate should more often feature recreational legalization than Republican-dominated states.

Individual identities intimately influence marijuana consumption habits and attitudes on legalization, which offers valuable insights into differences between states' marijuana policies based on the relative predominance of certain groups. Certain age, gender, religious, and partisan groups exhibit both increased consumption and support for recreational legalization. Since certain aspects of individual identity correlate to increased support for recreational legalization, the relative predominance or absence of these groups in certain states should cause different legalization outcomes across states. Ultimately, while the preceding analyses of varying groups illuminate the potential influence of marijuana usage, age, gender, religion, and partisanship in driving different states' recreational legalization policy, further research is required to empirically evaluate the influence of these factors.

California: Lessons from Preposition 19 (2010) and Preposition 64 (2016)

In 2010, California attempted to legalize recreational marijuana via the initiative. The measure (Preposition 19) narrowly failed to pass, with 53.46% of citizens voting against and 46.54% in favor. Six years later, Californians tried again, voting to pass Proposition 64 (an initiative) by a margin of 57.13% in favor of versus 42.87% against. The dynamics driving this change in voting outcome merit consideration. First, public opinion shifted towards supporting legalization. Second, proximate states legalized recreational marijuana. Third, a "new" governor assumed power. Finally, campaign financing swung drastically in favor of recreational legalization. By comparing the failed 2010 initiative to the successful 2016 initiative, this section highlights idiosyncratic and systematic variations which drove California's legalization of recreational cannabis, offering supplemental insight into the factors driving legalization outcomes elsewhere in the 50 states.

Between 2010 and 2016, public opinion moved towards support for recreational legalization. These gains applied ubiquitously, regardless of age, political affiliation, or race. Noteworthily, for the first time in 2016, most California adults aged 55 or older shifted to in favor of legalization. As discussed previously, this group is typically one of the most opposed to recreational legalization, but perhaps increased exposure and use of medical marijuana (this group uses medical marijuana the most, which was already legal in California) reassured older adults of the benign nature of legalization. Such an argument supports this paper's earlier hypothesis that marijuana usage causes increased support for recreational legalization; however, this merits future empirical study. More surprisingly, the group which experienced the largest upswing in support was Republicans, with a drastic increase from 34% to 44%, suggesting bipartisan support for recreational legalization and complimenting earlier arguments for policy attitude convergence regardless of party. These results directly explain why the 2016 initiative passed comparative to the 2010 attempt. In 2010, only 49% of voters favored recreational legalization while in 2016, 55% supported legalization, statistics nearly identical to the rates of for in both initiatives (46.54% in 2010 to 57.13% in 2016).

However, understanding *why* these attitudes changed is a more pressing question. Two intertwined explanations are governor support and interstate policy diffusion. In 2010, California governor Arnold Schwarzenegger expressed explicit opposition to recreational legalization.

While admitting "it's time for a debate," Schwarzenegger officially opposed Preposition 19 (the 2010 marijuana legalization initiative), arguing instead for Californians to "study very carefully what other countries are doing." Recall, not a single state had recreationally legalized marijuana in 2010, a successful initiative was unprecedented, and thus, to Schwarzenegger, incredibly risky. Schwarzenegger's comments support this paper's claim that policy diffusion, or the observance of policy consequences in proximate states, drives either support or aversion to policy experimentation, specifically in the context of recreational marijuana. Moreover, this reluctance plausibly applies to the broader population who have not observed the benefits or detriments of legalization in proximate states, partially explaining the unfavorable public opinion data.

Crucially, the recreational policy landscape changed drastically over the next six years, with four states legalizing marijuana, including geographically proximate Colorado and Washington. Meanwhile, in 2011, a governor open to, but not convinced of, recreational legalization assumed power: Jerry Brown. In 2014, two years prior to California's recreational legalization, Brown said, in reference to Colorado and Washington, "I'd really like those two states to show us how it's going to work." Once again, policy outcomes in proximate states clearly have a measurable influence on California governors' attitudes and consequent policy positions. While Governor Brown remained undecided on recreational legalization, the percentage of Californians favoring recreational legalization steadily increased as the consequences of recreational legalization (largely positive) bore out in Colorado and Washington,, Thus, California's path to legalization reveals the importance of interstate diffusion and policy observance in determining legalization outcomes, also demonstrating how governor position taking can positively, or negatively, influence legalization prospects.

A more obvious explanation for the diverging results between the 2010 and 2016 initiatives exists in campaign finance. In 2010, proponents of legalization struggled to raise over a million dollars, mustering only $1,192,000 versus legalization opponents' $423,000. While more money supported for than against, the difference proved insignificant; after all, $1,192,00 only covers a couple advertisements. Six years later, supporters of recreational legalization raised a remarkable $22,849,000. In all likelihood, such a drastic increase in funding reflects an increase in issue salience, which consequently resulted in inflated public awareness of the pro-legalization drive. Perhaps more importantly, pro-legalization contributions were 12 times larger than anti-legalization finances. This differential offers a crucial explanation for the differential outcomes in 2010 and 2016; exposing groups almost exclusively to pro-legalization ads and information resulted in a shift in attitudes towards favoring recreational legalization. Ultimately, differing amounts and relative contributions partly explain why the 2016 initiative succeeded while the 2010 attempt failed, offering insight into why both recreational marijuana and other initiatives succeed in different states.

The different outcomes of Preposition 19 (2010) and Preposition 64 (2016) offer insight into factors driving legalization outcomes in other states. California presents lessons on the importance of public opinion, policy observance/diffusion, influence of political officials, and campaign finance in dictating policy outcomes of recreational legalization. Additional research should empirically evaluate how these dynamics affect legalization outcomes in other states, along with California.

Where Can You Get High and Why?

This paper demonstrated that regional trends, the predominance of certain population identities, and state-specific dynamics affect recreational cannabis legalization decisions across the US states. Regional features, specifically policy diffusion, political culture, and the presence of the initiative, explain the otherwise inexplicable absence of recreational legal states in the southeast. Population identities such as age, gender, religion, or partisanship, dictate initiative success, the election of pro-legalization representatives, and the influence of public opinion in incentivizing legislative action favoring legalization. These two explanations inherently intertwine: the predominance of pro-legalization identity groups in southeastern states exert less influence than in Western states because of the absence of direct democracy. Moreover, certain groups, specifically white evangelicals, tend to congregate in southeastern states, affecting state political culture and reducing popular support for recreational legalization. Thus, both regional and population characteristics influence legalization outcomes, although the relative salience of these factors merits future consideration.

Concerning California, failed Preposition 19 (2010) and successful Proposition 64 (2016) offer unique lessons based on evolving state and regional dynamics between the two attempts. Evident here are the influences of governor position taking and public opinion but also changing regional policy; indisputably Colorado and Washington's successful legalizations contributed to public opinion shifting towards and increased public finance for the pro-legalization side.

Most importantly, herein exists the most important scholarly contributions of this paper: interstate diffusion, or policy consequence observance, informs and reassures legislatures, governors, and the public alike, facilitating the adoption of recreational cannabis legalization. Altogether, region, population identity, and state particularities all influence differential recreational legalization outcomes across the US states.

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Meet the author:

Sania Khazi is a current sophomore at UNC studying Public Policy and Economics. While taking PLCY 354 The Lived Experience of Inequality and Public Policy her first semester at UNC, she developed a deep research interest in the residual effects of Depression Era redlining practices which continue to be strengthened today. Through her coursework, she has been able to produce research papers on the social, economic, and environmental injustices that members of historically redlining communities continue to face, proposing potential solutions to policymakers to kickstart the discussions she believes can turn into change.

GLOBAL WARMING AND LOSS OF BIODIVERSITY AS FELT IN HISTORICALLY REDLINED COMMUNITIES
Sania Khazi

The effects of redlining that took place under the Home Owners' Loan Corporation in the 1930s are still felt today. The New Deal Era mortgage lenders' declarations of community risk level based off the number of African American and immigrant residents instituted segregationist housing policies. This historic racism has reverberated into a series of identifiable differences in how the present-day phenomenon of global warming is felt in redlined regions, versus those outside these arbitrary yet racist boundaries. With the threat of rapid biodiversity loss due to modern day urbanization trends, it is necessary to identify which populations are feeling adverse environmental effects the hardest, how those communities ended up in that position, and how they specifically can be helped. This paper will detail the negative impact of redlining on marginalized groups in urban communities under a lens of global warming and secondly, general access to nature, ultimately comparing and recommending policy solutions which remedy the issues at hand.

Problem Definition:

As suburbanization became a possibility for black and brown communities in the early 20th century, so did a system of residential segregation as white families fled to monochrome neighborhoods. By 1933, under Franklin D. Roosevelt, the Federal Housing Administration and its subsidiary, the Home Owners' Loan Corporation (HOLC), was established with a goal to bring national financial relief after the Great Depression through monetary mortgage assistance. In reality, though, a majority of these funds were only allocated to the white population.

In cities throughout the United States, trends created by historic redlining practices have persisted today, as urban minority populations remain in great numbers in the regions they were restricted to during the 1930s, which were D-graded by the HOLC. Thus, a relationship between redlining policies and access to a biodiverse environment can be found, with such access divided along the lines of race. With the development of certain regions as heat islands and a rapid loss of biodiversity that further strengthens the degradation of the planet, urban planning today must be intentional in its effort to bring biodiversity to historically redlined communities.

In a 2020 study of 108 US urban areas, Jeremy Hoffman and his colleagues found that in about 94% of cases, there were warmer present-day land surface temperatures in areas that were D-graded, in comparison to A-graded areas, some having differences of nearly 13 degrees (Hoffman et al., 2020). Further, the Hoffman study documented the correlating difference in the amount of area covered by tree canopy shade to nearly 60% more tree canopy coverage in A-rated areas, as well as almost 50% more impervious land in D-graded areas (Hoffman et al., 2020). With an abundance of impervious surfaces which absorb heat (ie. concrete) in conjunction with few trees, the historically D-graded areas become urban heat islands, or pockets of significantly hotter environments.

The present-day differences in environment between historically A-graded and D-graded communities within the same urban city are empirically reflected in Figure 1 below, "The Largest Heat Discrepancies," which denotes the differences in surface temperature between redlined neighborhoods and the highest-rated neighborhood for each city. In the case of Portland, Oregon, where nearly 78% of the city was graded a C or D under the HOLC, those regions are nearly 13 degrees Fahrenheit warmer than their A-graded counterparts.
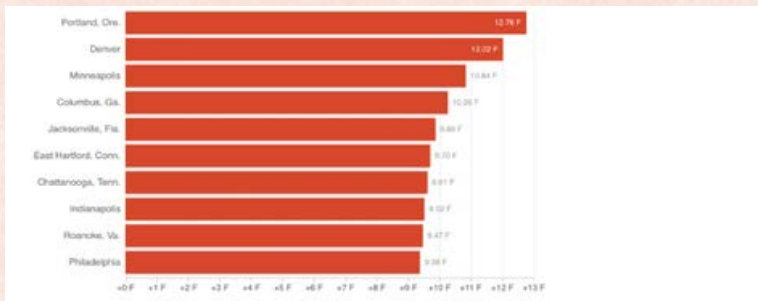
Figure 1. (Anderson, M. (2020, January 14). *Racist Housing Practices From The 1930s Linked To Hotter Neighborhoods Today*. NPR.org. Retrieved October 11, 2022)

As heat waves grow in intensity and frequency, extreme heat kills more Americans every year. In a Howard University publication with NPR titled "Code Red," the writers illustrate the specific health effects of rapidly rising temperatures: "more trips to the hospital for heart, kidney, and lung ailments. Drugs to treat mental illness and diabetes won't work as well. Pregnant women will give birth to children with more medical problems" (Howard Center for Investigative Journalism, n.d.). The environment and atmosphere present in a historically A-graded area under redlining is one that flourishes off the cooling capacity of trees and have frequent green spaces that serve as pervious ground for temperature regulation. It creates what researcher Christopher Schell describes as a "luxury effect," meaning that better ecological outcomes arise in wealthier areas, due to an abundance of proactive planning, and a lack of historic discrimination. He then goes on to describe that in low-income neighborhoods, however, there is no hope for the luxury effect to better the atmosphere because of air pollution sources that are often collocated in these areas (Schell et al., 2020).

In broadening the scope of the environmental impact of historic racial inequality policies, the overall biodiversity and ecological health of plants and animals in cities are degrading, especially in tandem with the rate of urbanization. Researcher at UC Berkeley Max Lambert describes how efforts have been prioritized since 2018 to build human-created stormwater ponds in cities to control flooding, deal with pollutants, and create habitats for native species. However, "these types of ponds typically aren't as common – or are often entirely absent – in neighborhoods that have experienced a legacy of racist and classist practices" (Manke, 2020). In biodiversity sampling research performed by Ellis-Soto and his team, they used bird biodiversity as an indicator of overall biodiversity, claiming they are the best sampled taxa. They found HOLC A-graded areas have more than twice the sampling density compared to formerly D-graded areas, with D-graded areas having the largest number of diversity cold spots. This trend is represented in Figure 2, which highlights New Haven, Detroit, and Los Angeles in smaller bar charts for each city that show the low levels of sampling density in D-graded regions of the cities.

Figure 2. (Ellis-Soto, D., Chapman, M., & Locke, D. (2022, June 9). *Uneven biodiversity sampling across redlined urban areas in the United States.*)

The disparities of bird records of the past 90 years in historically redlined communities show what the researchers amount to be the bias in histor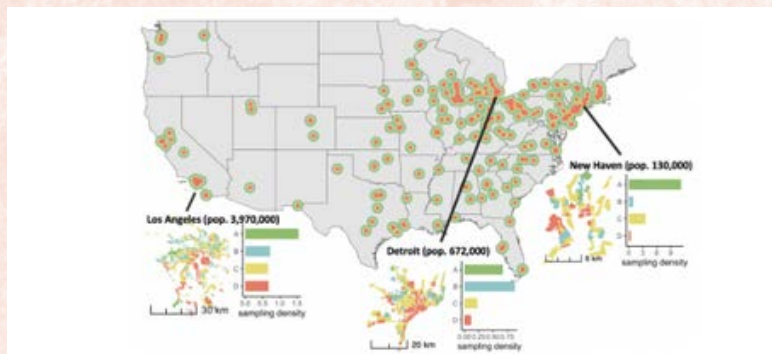ic data collection. Ellis-Soto claims historic biodiversity sampling has attempted to discount the issue of falling levels of biodiversity in historically redlined communities, by simply not sampling in those areas at all (Ellis-Soto et al., 2022). As new technology and research like that of Ellis-Soto and Max Lambert arises, it becomes increasingly evident to scientists and policy makers alike that focused environmental policy is necessary for redlined communities.

Goals

The goals of this policy brief are to consolidate and suggest implementable solutions to bridge the gap between global warming effects as felt in high-income communities, versus low-income, historically redlined areas. The suggested solution in this paper should heal environmental issues by means of social justice policy. Ideally, any effective government policy will be dual-purposed, and for that reason, doubly efficient as it would combat factors such as pollutants and global warming that play into the broader issue of climate change, as well as tackling the residual injustices of the 1930s that remain hidden yet entrenched in societal structure today.

Role for government

Analyzing this issue of environmental injustices through an economic lens motivates the need for government intervention, as several negative externalities and inefficiencies of the status quo come to focus. Firstly, for the millions of low-income households situated on heat islands in big cities across the US, economic failure manifests in the loss of able-bodied workers coming out of these households. The double-edged sword of the unseasonable heat as well as the pollutants only increases the propensity of these individuals to develop health conditions which they may not have the resources to fully recover from. Second, the environmental conditions of global warming and a loss of biodiversity are bound to inefficient food production.

Rising levels of habitat loss and heat waves in addition to human pollutants diminish soil and water quality and a lack of untouched, permeable landscapes in urban areas reduce nature's effectiveness to store CO_2, further diminishing future propensity to produce (The Global Carbon Market, n.d.). Already, the decline in the global ecosystem's functionality to regulate CO_2 emissions costs the global economy more than $5 trillion a year in the form of newly necessary services such as water storage and filtration, and air purification (Kurth et al., 2022).

Reintroducing the ethical argument, each of the previously detailed economic inefficiencies as well as the basic status of discomfort and poor health felt by a resident of a heat island is being felt hardest by those who have historically always felt the most hardship. This is perhaps the biggest push for government intervention, as it may work towards leveling out the playing field in terms of opportunities for all communities to have access to an increasingly similar amount of wellbeing.

The federal government has an obligation to promote racial equality in the United States, as a society of non-discrimination continues to be a policy goal for the US government since the Civil Rights movement. Already imposed anti-discrimination legislation like the Civil Rights Act will be better upheld with a government promoting environmental justice, as eliminating inequalities of biodiversity and climate issues would make any opportunity, including job opportunities, more accessible.

Criteria and Alternatives

The three criteria by which policy alternatives will be evaluated are effectiveness, equity, and political feasibility. Effectiveness will be quantitatively assessed according to how well the policy achieves the goal of reducing the heat island effect in historically redlined urban communities.

The next criterion of equity is going to be defined as justice and fairness in the distribution of costs and benefits of the policy between the warmer urban regions which represent the policy problem, and the wealthier and temperature regulated urban regions. Lastly, ranking the policy alternatives based on political feasibility will evaluate the extent to which elected officials might realistically support and promote the proposed solution, keeping in mind that climate change in general is an issue that can be divided along partisan lines.

Alternative 1: Public Green Infrastructure

The US Department of Housing and Urban Planning could implement a Green Infrastructure program which initially targets the cities in which heat differences are the highest between their high-income communities and historically redlined communities (seen on Figure 1, page 4). Green Infrastructure (GI) would include any public environmental asset that contributes to the surrounding ecosystem and sustainability of the community in an urban area (Leal Filho et al., 2021). The construction of greenways, urban parks, recreational courtyards in business centers, public gardens, and stormwater pond installation are all examples of possible projects that would be funded under a GI program. Ideally, this program would grant each city the funds to implement a project of their choosing which best integrates into their natural ecosystem, utilizing regionally native species and prioritizing the planting of trees for increased canopy coverage and cooling.

This policy alternative has the potential to be quite effective, as data from past municipal efforts to increase green spaces can be used as a point of reference as the possible results of a federal GI program. In 2018, the National Oceanic and Atmospheric Administration (NOAA) funded "urban tree park projects" in Washington, DC and Baltimore, Maryland which revealed differences of up to 17 degrees between new park space and cement streetscapes. In his analysis of the NOAA study, Dr. Vivek Shandas, professor of climate adaptation, identified parks as the number one place for climate refuge: "they can improve our resiliency to hotter summers and more extreme precipitation and help us in these times of uncertainty… especially for communities that don't have many options for stay cool" (Forderaro, 2022). A cooling effect of up to 17 degrees would more than offset the 13-degree Fahrenheit heat discrepancy between the previously described A-graded and D-graded regions of Portland, Oregon, reducing the heat island effect altogether.

The main variable costs for GI projects arise because "urban heat islands affect all cities in an uneven way," and "the cost of forestry ranges across ecosystems" (Heat Island Cooling Strategies, n.d.). To the benefit of this policy alternative, GI projects would be government funded with amount of funds being calculated based off each city's specific project, so it would not rely on any one resident's resources. Thus, as with most public infrastructure projects, the Green Infrastructure policy option has the propensity to be very equitable.

Alternative 2: Monetary Incentives for Green Roofs

Green roofs, or rooftop gardens are a vegetative layer grown on a rooftop that provide shade, remove heat from the air, and reduce temperatures of the roof surface and surrounding air. The monetary incentive guidelines for this policy alternative would be modeled off the city of Toronto's Eco-Roof Incentive Program, which provides both individuals and businesses approximately $8 USD per square foot of vegetated roofing installed (*Eco-Roof Incentive Program,* 2022). Both existing and new residential and commercial buildings would be eligible, there would be specific requirements regarding a minimum percent coverage of the roof with vegetation, and a cap would have to be put on incentives for particularly large buildings.

With the residents of urban heat islands in mind, green roofs would be effective in their ability to "reduce heat transfer through the roof of a building, improving indoor comfort and yielding human health benefits, particularly in non-air-conditioned buildings" (Bell et al., 2008).

Generally speaking, green roofs would be one of the few options for consideration at all in the instance that an urban heat island has no ground space left to convert into a permeable plot. Once again returning to the study of Portland, Oregon, green roofs would benefit neighborhoods immensely through reduction in storm runoff, capturing between 50 and nearly 100 percent of incoming rain—a useful resource as rainfall increases in intensity due to climate change (Bell et al., 2008). In Portland, over a 15-month period, one EPA study found a reduction of runoff of almost 70 percent, with a reduction in peak run-off rates of 95 percent during intense storms (Bell et al., 2008).

The race-based inequalities felt in urban heat islands are most felt by individuals. By putting the role of green roof implementation onto households, this not only forms an inequitable divide regarding whether one can monetarily afford to start the project, but also whether one has the time and physical capability to engage in green-industrial projects or upkeep for their own residence. The average green roof costs about $10 per square foot (Heat Island Cooling Strategies, n.d.). With the minimum percent coverage requirements of the proposed policy, individuals may not be able to afford to begin the project under the incentive program. The Toronto Eco-Roof Incentive Program provided a grant of up to $1,000 for pre-installation structural assessment, which on its own would only finance 100 square feet of green roofing. In incentivizing green-roof installation entirely after the fact, the monetary benefit is being given to those who already had the money to fix their personal heat island related problems, making this inequitable for the majority who suffer in urban heat islands.

Alternative 3: CO2 Emissions-Based Regulations, Clean Car Rules

This final alternative takes a starkly different approach to remedying the heat island effect, as it is more concerned specifically with lowering carbon emissions by making them less likely to be produced, rather than planting vegetation to accommodate for the current levels of CO2 emissions. California's Advanced Clean Cars II regulation states that in any district where the regulation has passed, every new car and truck sold by 2035 will be zero emission. A city-by-city implementation of Carbon emissions regulatory policies such as California's Clean Car Rules would form an approachable means for CO2 emission mitigation.

Carbon dioxide in the atmosphere warms the planet, a major causal factor of global warming. Human activities, such as an American's propensity to travel by private vehicle, have "raised the atmosphere's carbon dioxide content by 50% in less than 200 years" (Carbon Dioxide, n.d.). A shift in urban regions to a policy such as the Advanced Clean Cars II regulation would provide 100s of billions of dollars in national health benefits, as it is estimated to result in $14 billion in health benefits for California alone (Harris & Mui, 2022). While this may help to mitigate the unequally felt health issues that heat island residents face, this policy option is not directly effective in targeting resources to the hotter, most in need sectors of a city, and rather takes a more general, but less effective approach.

There is certainly a major inequitable divide in access to electric vehicles between the wealthier and those who may not be able to afford them for the high market value at which they currently stand. In implementing such a policy, the result would be that those unable to afford a private electric vehicle would either take public transportation or walk, as urban cities are meant to be walkable. However, it is unjust to, in essence, completely restrict a portion of the population from having a form of private transportation, especially if it is that population that is already relatively worse off in how they feel the effects of global warming.

Political Feasibility

The least politically feasible policy alternative in today's political climate is likely the Clean Car Rules, as it is the most drastic change to everyday life. US automobile manufacturing is a $100.9 billion industry, but one that had declined faster than the manufacturing sector overall (Car & Automobile Manufacturing in the US, n.d.). This being the case, many representatives of states in which such factories are housed push for legislation that would grow the market, and keep workers employed. It happens to be the case that these are often right leaning representatives who are also less likely to side with drastic measures to fight climate change.

The Green Infrastructure policy, on the other hand, may be the most politically feasible, as there would be more room for legislative deliberation and resolution regarding the budget for this project. Additionally, GI projects would be much less invasive to everyday lives, and even have additional positive externalities that can be appreciated across partisan lines, such as places for recreation, urban agricultural production, and less noise pollution.

Recommendations and Conclusions

Evaluating against the criteria of effectiveness, equity, and political feasibility, the policy alternative to fund Green Infrastructure projects is the best policy for implementation. The freedom for each city to decide which GI project to implement allows for a product that fills in an ecological factor that was missing. For example, if the area near an urban heat island in one city requires a large permeable surface to control rain run-off, as well as a spot for shaded recreation for the neighborhood's children, perhaps the project would be to build a courtyard between urban apartment buildings, connecting them with tree canopy-lined walking paths.

Further, the fact that this policy is budget-based, and will grant different portions of the budget to different cities is cost effective in that it accounts for the fact that the price of ecological upkeep varies in different ecosystems throughout the US. However, no matter the cost, the benefits of reduced energy use, improved air quality, enhanced stormwater management, reduced atmospheric temperature, and general improved quality of life outweigh the $15 to $65 annual per tree costs (Heat Island Cooling Strategies, n.d.).

The main variable in this policy alternative is the budget that would be decided by the legislature. This being so, it would be best to approach the first period of GI projects as a trial period, selecting cities with the hottest heat islands in comparison to their surroundings. Then, whatever funds which are allotted to the projects must be equitably distributed in each of the cities for their given GI project development.

Finally, a study should be done first, specifically on the changes in temperature of the targeted heat islands, and second, by conducting a cost benefit analysis accounting for other benefits and positive externalities. If the benefits outweigh the costs, and the heat island temperatures are decreasing, the program is effective and it should continue through the next GI project period, in other cities across the US.

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Meet the author:

Hi! This is Yifei Pei. I am a senior double majoring in Economics and Psychology. I am broadly interested in decision-making, especially the factors that drive the irrationality in the process. My additional interest lies in adolescents' health behaviors and their social consequences. I am passionate about research and have been actively engaged in Dr. Susan Girdler's lab, Dr. Paschal Sheeran's lab, and Dr. Nisha Gottfredson's research project. My UNC JOURney submission is the final product of a summer independent research project under the mentorship of Dr. Girdler and the sponsorship of SARIC. I am currently completing an Honor Thesis with Dr. Sheeran, studying the distinction between motivation and energization. I am hoping to further pursue my research interests in graduate school as a Ph.D. student in Behavioral Psychology.

Body Esteem, Depressive Symptoms, and Academic Performance in Adolescent Girls and Boys
Yifei Pei

Abstract

The study sought to understand the relationship between body esteem, depressive moods, and academic achievement among adolescents. No prior study examined the relationships between body esteem, depression, and academic achievement by gender. This study aimed to investigate whether gender differences exist in 1) the relationship between body esteem and academic performance, 2) the relationship between depressive symptoms and academic performance, and 3) the relationship between body esteem and depressive symptoms. The analyses yielded evidence that suggested the possibility of gender differences in the relationship between measures of body esteem and weighted GPA and in the relationship between measures of body esteem and depressive symptoms. A positive correlation between general body esteem and academic performance was found only in boys. Negative correlations between all measures of body esteem and depressive symptoms were only found in girls.
Keywords: body esteem, depressive moods, academic achievement, adolescents, mental health

Introduction

Academic achievement is one of the central challenges faced by the adolescents. Students who have good academic performance at school tend to have more career opportunities in the future (Zheng et al., 2020), whereas low academic achievement is associated with mental health problems (DeSocio & Hootman, 2004), increased risk for substance use (Fothergill et al., 2008), and increased suicidal attempts (Sörberg Wallin et al., 2017). Given the significance of academic achievement to adolescents, it is important to investigate the factors that can potentially improve or hinder academic performance.

Self-esteem, characterized as an individual's global evaluation of his or her overall worth as a person, is relevant for a number of important personal and social life outcomes (Steiger et al., 2014). For example, research has shown that self-esteem is associated with academic achievement (Zheng et al., 2020). However, most previous research focused on global self-esteem and academic self-esteem but neglected domain-specific self-esteem not pertaining directly to school such as body esteem. Global self-esteem refers to the general feelings we have about ourselves. Domain-specific self-esteem reflects a person's self-evaluation regarding a specific domain; for instance, body esteem refers to how people evaluate their body due to physical appearance, weight, and evaluations from others (Mendelson et al., 1997).

The past research has at least two gaps. First, although a meta-analysis found a consistent and favorable influence of positive self-beliefs on academic achievement (Valentine et al., 2004), however, broadly defined (i.e., global) self-beliefs or self-esteem cannot adequately represent the diversity of content-specific domains of self (Marsh, 1993). Second, although the reciprocal relationship between academic self-concept and academic achievement has been documented (Marsh & Craven, 2006), it is crucial to understand how parts of self-concept other than academic competence impact students' achievement in the context of school. Parts of self-concept may be arranged hierarchically according to individual experiences and particular situations (Shavelson et al., 1976). Since adolescents experience great changes in their body weight and physical appearance during the pubertal transition, the possibility exists that physical attributes may be placed in the top hierarchy of their self-concept and play a more significant role in all parts of their lives than in any other time period. The existing literature has explored negative body concepts among teens, establishing the effect of appearance and weight dissatisfaction on a number of important outcomes, including academic performance (Aimé et al., 2016; Paxton et al., 2006). However, there is a lack of research on the potential relationship between body esteem (i.e., a comprehensive and neutral evaluation of one's body image due to physical appearance, weight, and evaluations of others) and important outcomes such as academic achievement.

Moreover, the vast majority of the prior research has not examined how gender may play a role in the relationship between body esteem and academic performance. It is unknown whether the negative relationship between poor body image and academic performance applies to both genders (male and female) or female/male only. Therefore, it is important to investigate the relationship between body esteem and academic performance by gender.

The literature has extensively looked at the relationship between academic performance and depression. While some have argued that poor academic performance predicts depression (Sörberg Wallin et al., 2018), others argue that depressive symptoms predict low academic performance (Haines et al., 1996; English et al., 2016). Few studies took gender into consideration, and the ones that controlled for gender mostly focused on girls. For instance, one study that found no correlation between academic performance and depressive mood included only girls (Aimé et al., 2016). Given the potential gender differences, therefore, it is important to investigate the relationship between academic performance and depressive symptoms by gender.

The literature has linked measures of body esteem to depression among adolescents. Prior studies showed that adolescents' perception of their poor physical appearance and body dissatisfaction predict depressive symptoms (Steiger et al., 2014; Paxton et al., 2006). It was documented that body esteem, measured by Body Esteem Scale for Adolescents and Adults (BESAA), predicts depression (Jónsdóttir et al., 2008). While it was shown by previous literature that women have significantly lower body esteem and higher depression when compared to males (Davis & Katzman, 1997), few studies systematically examined the gender differences in the relationship between body esteem and depression.

Among the studies that investigated gender differences, most of them focused on girls and found evidence that poor perceived body images were related to depressive mood (Aimé et al., 2016). However, it is unclear whether the negative relationship between body esteem and depressive symptoms applies to boys. Therefore, it is necessary to analyze the relationship between body esteem and depressive symptoms by gender.

In conclusion, the literature indicates that poor body image is linked to worse academic performance and more depressive symptomatology. There is also a negative impact of depressive symptoms on academic performance found in prior studies. However, no prior study has examined the relationships between body esteem, depression, and academic achievement by gender. Studies have found that girls are at higher risk for developing depressed moods and that girls have greater depression symptoms compared to boys (Petersen et al., 1991; Patil et al., 2018). In addition, girls in general have higher levels of academic achievement and obtain higher grades than boys in high school (Fortin et al., 2013; Marsh et al., 1985). Given the gender differences in these important outcomes, it is crucial to address the potential gender differences in the relationship between body esteem, depression, and academic achievement. To address this lack of knowledge, this study aims to investigate whether gender differences exist in 1) the relationship between body esteem and academic performance, 2) the relationship between depressive symptoms and academic performance, and 3) the relationship between body esteem and depressive symptoms.

Method

Participants

Data came from a subset (Cohort 2) of the ARCHIVE study (Prinstein, 2010). ARCHIVE collected data from February 2009 until April 2017, at local high schools in Chapel Hill, North Carolina. The original sample size was 172; after excluding the participants with missing values in the targeted variables (body esteem, depressive symptoms, weighted GPA), the sample size was reduced to 81. Participants included in the final sample have a mean age of 15.3. The adolescent participants are broadly representative of the Chapel Hill population concerning gender, ethnicity, and race distribution, and education level of their parents. The gender distribution is roughly equal, with 53.1% female and 46.9% male. The ethnic and racial background of the sample is 37% White, 28.4% African American, 23.5% Hispanic, 1.2% Asian, and 9.9% of mixed or other ethnicity. The majority of the participants' parents (66%) did not hold a college degree (see Table 1 for sample demographics).

Measures

Body Esteem. Body esteem of adolescents in this study was measured with 23 items (9 negative and 14 positive items) from the Body-Esteem Scale for Adolescents and Adults (BESAA; Mendelson et al., 1997). According to Mendelson et al., body esteem (BE) comprises three dimensions: BE-appearance ("feelings about one's general appearance"), BE-weight ("feelings about one's weight"), and BE-attribution ("evaluations attributed to others about one's body and appearance")

Participants rated each item on a five-point Likert scale, ranging from 0 ("never") to 4 ("always"). Studies have shown that the scale used on BESAA has good model fit statistics and exhibits both internal consistency and test-retest reliability (Cragun et al., 2013; ARSLAN et al., 2020). Following the validating scoring method of Mendelson (Mendelson et al., 1997), positive items include statements such as "I am satisfied with my weight." Negative items include statements such as "Weighing myself depresses me." For the purpose of this study, the scores of each response were summed; when calculating the sum, the positive items were treated as positive, whereas the negative items were treated as negative. The total possible score of an individual's body esteem ranges from -36 (all the negative items being marked -4 and positive items 0) to 56 (all positive items being marked 4 and negative items 0). The average general body esteem score for the total sample is 23, with no significant difference between girls and boys; the averages of the sub-scales in the total sample are the following: 5 for BE-appearance, 10 for BE-weight, 11 for BE-attribution, similarly with no significant difference between girls and boys (see Table 2 for the report on body esteem scores by gender).

Depressive Symptoms. Depressive symptoms were measured with 32 items from the Mood And Feelings Questionnaire (Item 19 —"I thought about killing myself."— was removed from the original questionnaire). The Mood And Feelings Questionnaire (MFQ) is a 33-item questionnaire assessing depressive symptoms over the past 2 weeks, with responses rated on a 3-point scale (0 = not true, 1 = sometimes, and 2 = true) (Costello & Angold, 1988). The MFQ is based on DSM-III-R symptom criteria and has been recommended by the National Institute for Health and Clinical Excellence for the screening of depression in children and adolescents (Thabrew et al., 2018). For this study, the scores of each item were summed, resulting in a scale ranging from 0 to 64. The mean score across all the participants is 14, with no significant difference between girls and boys (see Table 2 for scores reported by gender). The literature has commonly reported a score>=29 to be predictive of clinically significant depression (Burleson Daviss et al., 2006). In this study, there are 12 participants whose scores are greater than 29 out of the total scores, of which 4 are boys and 8 are girls (the difference is not significant).

Academic Performance. In this study, academic performance was measured in terms of weighted GPA. Weighted GPA is measured in Chapel Hill High Schools on a scale ranging from 0 to 5.0, with harder classes earning the higher designation. An A in a standard course is equivalent to a 4.0 GPA, while an A in an advanced course is equivalent to a 5.0 GPA. In the original data, the weighted GPA of three years (year 1 to year 3) in high school was included. For this study, the weighted GPA for three years was averaged for each participant to get one general indicator of the student's academic achievement. The mean weighted GPA for all the participants is 2.87 with a standard deviation of 0.96. Although girls have a higher weighted GPA on average than boys, the difference is not significant (see Table 2 for details).

Data Analysis

Pearson-Product Moment Correlation tests were conducted using SPSS to examine the general relationships among variables (see Table 3). Additionally, relationships were also examined among different sub-scales of body esteem and weighted GPA, and depressive symptoms scores. Next, correlational tests were conducted separately by gender (see Table 4 & Table 5). Scatterplots were developed to depict the relationships between variables of interest.

Results

Relationship Between Body Esteem and Academic Achievement

Total Sample (Table 3). Body esteem and academic performance were positively correlated ($r = 0.289$, $p < 0.01$), such that a higher level of body esteem was correlated with a higher weighted GPA when considering the whole sample together.

The present study also examined the correlations between weighted GPA and each sub-scale of body esteem (BE_Appearance, BE_Weight, and BE_Attribution). Among these sub-scales, BE_Appearance and BE_Attribution were found to be positively correlated with GPA ($r = 0.243 - 0.319$, $p < 0.05$), whereas BE_Weight was not significantly correlated with GPA. In other words, the better one felt about one's appearance (BE_Appearance), the higher one's GPA; similarly, the better the evaluation of one's body and appearance attributed to others (BE_Attribution), the higher one's GPA. However, one's weight satisfaction was not correlated with one's weighted GPA.

As expected, general body esteem was correlated with each of its three sub-scales: BE_Appearance, BE_Weight, and BE_Attribution ($r = 0.686 - 0.890$, $p < 0.01$; see Table 3). Among the three sub-scales, each was significantly correlated with one another ($r = 0.397 - 0.635$, $p < 0.01$; see **Table 3** for details).

By Gender

Boys (Table 4). For male students, consistent with the total sample, general body esteem was significantly correlated with academic performance. The higher the general body esteem, the higher the boys' weighted GPA. Among the three sub-scales, only BE_Attribution was positively correlated with GPA ($r = 0.458$, $p < 0.01$). In other words, for boys, the better the evaluation of one's body and appearance attributed to others, the higher GPA. Feeling about the general appearance and weight satisfaction were not related to academic achievement in boys.

Girls (Table 5). When looking at the relationship between measures of body esteem and academic performance for female students only, no significant correlations were observed. In contrast to the total sample, none of the measures of body esteem, including general body esteem and three sub-scales, were significantly related to weighted GPA for girls.

See Figure 1 for scatterplots depicting the relationship between overall body esteem and weighted GPA in the entire sample and separately by gender.

Relationship Between Depressive Symptoms and Academic Achievement

There were no significant relationships between depressive symptomatology and weighted GPA either for the total sample or when examined separately by gender (see Figure 2).

Relationship Between Body Esteem and Depressive Symptoms

Total Sample. Lower body esteem was linked to more depressive symptoms (r = -0.312, p < 0.01), indicating that depressive symptoms were negatively correlated with body esteem for high school students. Among the three sub-scales of body esteem, BE_Appearance (r = -0.307, p < 0.01) and BE_Weight (r = -0.259, p < 0.05) were significantly correlated with depressive symptoms but not BE_Attribution. In other words, a lower score on feelings about perceived general appearance was associated with more depressive symptoms (r = -0.307, p < 0.01). Similarly, less satisfaction with body weight was associated with more depressive symptoms (r = -0.259, p < 0.05). However, evaluation of one's body and appearance attributed to others was not related to one's depressive moods.

By Gender

Boys (Table 4) Among boys, there was no significant correlation between depressive symptoms and general body esteem, and none of the sub-scales of body esteem were associated with depressive symptoms.

Girls (Table 5). When looking at the relationship between depressive symptoms and general body esteem for girls, a significant correlation was found (r = -0.448, p < 0.01), such that greater depressive symptoms were associated with lower overall body esteem. All three sub-scales of body esteem were found to be negatively correlated with depressive symptoms among girls (r = -0.304 — 0.454, p < 0.05; see Table 5).

See Figure 3 for scatterplots depicting the relationship between overall body esteem and depressive symptoms in the entire sample and separately by gender.

Discussion

This study sought to address the literature gap where there was a lack of knowledge between domain-specific self-esteem—body esteem—and academic performance. The analyses yielded evidence that suggested the possibility of gender differences in the relationship between measures of body esteem and weighted GPA and in the relationship between measures of body esteem and depressive symptoms. First, the positive correlation between general body esteem and academic performance only held for boys. Specifically, it was BE_Attribution (evaluation of one's body and appearance attributed to others) that was correlated with academic performance in boys. Second, the negative correlations between all measures of body esteem and depressive symptoms only applied to girls. In particular, general body esteem and its three sub-scales were all significantly correlated with depressive symptoms in girls.

In contrast to the past literature that showed significant gender differences in academic achievement and depressive levels in which girls were significantly higher than boys on both GPA and depressive scores (Davis & Katzman, 1997; Fortin et al., 2013), the present study did not find significant gender differences in depressive symptoms scores, measures of body esteem, and weighted GPA. However, this investigation found the possibility that gender differences existed in the relationship between measures of body esteem and weighted GPA and in the relationship between measures of body esteem and depressive symptoms.

Body esteem and GPA. There was a significant correlation between general body esteem and weighed GPA for the total sample, indicating that the higher one's body esteem, the higher one's GPA. It makes intuitive sense that if we feel positive about ourselves, in this case—our body, we may have a higher level of self-efficacy for completing school tasks (i.e., assignments and tests) and be more confident in our ability to succeed in school. Examining the relationships between sub-scales of body esteem and weighted GPA in the total sample, the present study found that general feelings about one's appearance and evaluations of others were significantly correlated with GPA, whereas weight satisfaction was not. The possibility of gender differences was also observed in the relationship between body esteem and weighted GPA. In the current study, measures of body esteem in girls, including general body esteem and the three sub-scales, were not correlated with GPA. Among the body esteem sub-scales, boys' weighted GPA was only correlated with BE_Attritions (perception of evaluations attributed to others about one's body and appearance) but not with the other two body esteem sub-scales (BE_Appearance and BE_Weight). The correlation between overall body esteem and weighted GPA observed in the total sample seemed to be evident only in boys. Sub-scale analyses showed that among the measures of body esteem, it was mainly BE_Attribution (perception of evaluation of one's body and appearance attributed to others) that was correlated with academic performance in boys. Academic performance plays an important role in students' social life, and academic comparisons exist between peers (Schunk & Pajares, 2002). The fact that, among sub-scale measures of body esteem, only perception of evaluation from others is correlated with GPA suggests that boys may

place great importance on peer acceptance. When boys receive good evaluations from their peers about their bodies and appearance (i.e., BE_Attribution), they may feel at a higher social status. According to self-consistency theory (Lecky, 1946), adolescent boys will try to maintain a high social status. Research has shown that getting higher grades improves peer acceptance and peer group status (Véronneau et al., 2010). Therefore, it is possible that in order to maintain a positive social image, boys will intend to achieve a higher GPA to let their peers know about their achievements. While speculative, better academic performance observed in boys may also lead to higher BE_Attribution. When boys have a high GPA, they may receive a high social perception of personal worth and thus perceive a higher evaluation from others about their body and appearance (i.e., BE_Attribution).

However, the positive relationships between body esteem (general body esteem and BE_Attribution) and weighted GPA applied only to boys but not girls. It is possible that when attaining high grades, boys and girls are driven by different motivations. It has been found that girls' academic performance is significantly related to beliefs in their own instrumentality for success (Ghee & Crandall, 1968), such that girls believe that their academic achievements depend on their own perceptions of what would count as important factors that can affect their grades (Graen, 1969). For instance, if girls believe that confidence is responsible for their grades, they may demonstrate a high correlation between confidence levels and performance, such that when they feel extremely confident in a task, they will achieve a high score. It is possible that girls do not perceive body esteem as having direct effects on their grades, thus showing no association between measures of body esteem and weighted GPA.

Body Esteem and Depressive Symptoms. A significant, negative relationship existed between depressive symptoms and body esteem in the total sample. This finding was consistent with a prior longitudinal study that showed when people have low body esteem, they will develop more depressive symptoms (Steiger et al., 2014), and it also fits into the negative relationship between general self-esteem and depression (Orth et al., 2012). When examining the relationship separately by sex, the effects diverged from the one for the total sample. The correlations between depressive symptoms and measures of body esteem, including general body esteem and the three sub-scales, were significantly negative for girls but not for boys. It may be that girls tend to define themselves in terms of physical appearance and body image, internalizing the social standards for females (i.e., thinness), but boys do not (Vartanian, 2009). Thus, when girls have low body esteem (due to poor perceived appearance, weight dissatisfaction, poor perception of evaluations from others about their appearance and weight, or all the above), they may feel anxious and depressed because of their perceived failure to reach beauty standards in the culture. Higher levels of depressive symptoms observed in girls may leads to lower levels of body esteem in all subscales (BE_Appearance, BE_Weight, and BE_Attributioln). When girls suffer from high depressive levels, they may not be mentally capable of coping with the pubertal changes in their bodies and appearance and unfavorable evaluation from others, thus having lower body esteem (Paxton et al., 2006). In addition, depression has been identified as a risk factor for eating disorders: when girls have more depressive symptoms, they may be more susceptible to eating disorders that can lead to significant underweight or overweight, which in turn leads to lower body esteem (Puccio et al., 2016).

However, the negative relationships between measures of body esteem and weighted GPA applied only to girls but not boys. Past research found that body dissatisfaction predicts depressive symptoms in early adolescent girls and mid-adolescent boys (Paxton et al., 2006). Thus, it may be that the periods of adolescents during which boys and girls are sensitive to their body images are different, resulting in different psychological responses to body esteem levels based on gender at a particular time. The possibility exists that at the time when the data were collected in the current research study (i.e., early adolescents), girls were more vulnerable to the negative influence of body esteem on moods when compared to boys.

In conclusion, different attitudes about body esteem may be one reason why gender disparities exist both in the relationship between body esteem and weighted GPA and in the relationship between body esteem and depressive symptoms. Speculatively, girls may consider body esteem (including general body esteem as well as its three sub-scales) as a potential indicator of self-worth: when they have low body esteem, they may be preoccupied with thoughts filled with worthlessness, guilt, and hopelessness (i.e., suffering from depressive symptoms). Another possibility is that body esteem due to perception of evaluations from others (i.e., BE_Attribution) may be treated as a social indicator among boys that provides information about social relationships and about social status. It is possible that boys who perceive they have better evaluations from others about their body and appearance may work hard in order to achieve higher grades in order to maintain high social status and good interpersonal relationships.

Implications

While current interventions in adolescents have focused on improving general self-esteem, knowledge about the existence of correlations between body esteem and weighted GPA and between body esteem and depressive symptoms may give rise to innovative intervention programs involving improvements in body esteem with the aim to improve academic performance and prevent depressive symptoms. Given the potential gender differences in the relationships above that are observed in this study, future policymakers may tailor the interventions to address the unique needs of girls and boys. Specifically, interventions targeting girls should provide guidance on constructing positive views of body images to prevent the development of depressive symptoms. Interventions targeting boys should provide guidance on how to cope with perception of poor evaluation from others about their body and appearance to prevent possible negative influences on GPA. However, future studies are needed to validate the correlational findings in the current investigation to guarantee the effectiveness of such interventions.

Limitations

The present study has several limitations that warrant attention. First, given the number of correlations run in the limited sample size of the current investigation, it is possible that the observed significant correlations are due to Type 1 error. In other words, it is possible that the negative correlations between BE_Attribution and GPA found in boys is not true in the real-world context. It is also possible that the negative correlations between measures of body esteem (including general body esteem and the three sub-scales) and depressive symptoms observed in girls do not apply to real-world scenarios. Thus, it is important to replicate the study in a larger sample size to validate the findings.

Second, while correlational findings are valuable, they only provide information about the degree of linear relationship present in two variables and cannot test whether one variable affects the other. Regressions, however, can provide a stronger indication of such information by specifying the amount of change in the dependent variable attributed to one unit of change in the independent. This provides predictive power when, for instance, the level of depressive symptoms can be predicted by the level of body esteem. The ability to make predictions may be helpful in measuring the improvement outcomes of interventions. For instance, if the researchers want to lower the depressive levels by a mean score of 3 in one group of adolescent girls, they can keep track of the body esteem levels in the group and measure how much body esteem levels need to increase to reach the goal.

Although the result of this study suggests the possibility of gender differences, using the cross-sectional correlation design, in the relationship between body esteem and weighted GPA and in the relationship between body esteem and depressive symptoms, the directions of the above relationships remain unclear. First, in boys, does high body esteem due to perception of evaluation from others predict higher weighted GPA, does high weighted GPA predict higher body esteem, or is the relationship bidirectional? Second, in girls, do low levels of body esteem (including general body esteem and its three sub-scales) predict more depressive symptoms, do high depressive levels predict lower levels of body esteem, or is the relationship bidirectional? Therefore, it may be worthwhile for future studies to conduct regression analyses using a longitudinal design to explore the relationships between body esteem, weighted GPA, and depressive symptoms more in-depth.

Moreover, it is important to verify the gender differences observed in the relationship between body esteem and weighted GPA and in the relationship between body esteem and depressive symptoms. In the current study, we found that: 1) Only in boys, body esteem was positively related to GPA (body esteem and GPA are not significantly related in girls) and 2) Only in girls, body esteem was negatively related to depressive symptoms. Future researchers should test whether the gender differences are significant by comparing the strength of the correlation coefficients obtained in boys versus girls.

Third, due to the nature of correlational design, the observed relations in this study may result from the influence of extraneous variables that affect body esteem, weighted GPA, and depressive symptoms. Specifically, the possibility exists that there is a third factor that causes both high BE_Attribution in boys and high weighted GPA in boys and another factor that causes both low body esteem levels and more depressive symptoms in girls. Therefore, future investigations should conduct experimental studies to isolate the effect of body esteem on weighted GPA in boys and the effect of body esteem on depressive symptoms in girls. In addition, it is hard to explain the factors that lead to gender differences not only due to the dearth of research in the related area but also due to the correlational design of the current study. Thus, experiments should be conducted to control for confounding variables and find the reasons behind the gender differences in the relationships between body esteem, depressive symptoms, and weighted GPA.

In this study, body esteem was measured by Body-Esteem Scale for Adolescents and Adults (Mendelson et al., 1997). Given the increasing influence of social media on adolescents' perception of ideal body images, future researchers should adopt other approaches that take sociocultural influences into consideration when measuring adolescents' body esteem (Cusumano & Thompson, 1997). Academic performance was measured in this study by the average value of the first three years' weighted GPA in high school. If possible, future researchers can assess students' academic performance at different times to gain insights into how one's GPA changes over time. Future studies can also explore other dimensions of academic achievement such as the scores of standardized tests.

Conclusion

The present research contributes to the understanding of the relationship between domain-specific self-esteem and academic performance by focusing on the correlations between body esteem (both global and sub-scale) and weighted GPA. The study found that body esteem and weight GPA are positively correlated in boys but not in girls. This study also found a strong negative correlation between body esteem and depressive symptoms, but only in girls. These results suggest the possibility that gender differences exist in the correlations mentioned above, which deserves further explorations in future studies. It would be important for future researchers to investigate the importance of body esteem in adolescent well-being given the potential implications of body esteem on academic performance and depressive symptoms.

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Meet the author:

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Education in Egypt
Omar Farrag

Introduction and Discussion of Methods Used

My research topic investigates the disparities in Egypt's education system, focusing on primary and secondary school, the government's role in creating or exacerbating these disparities, and the effects these disparities have on students' educational progress and upward mobility. I split my research between urban Egypt (mainly Cairo) and rural Egypt (mainly Upper Egypt), and divided my research questions into four sections: differences between public and private education, access to educational support outside of the classroom, government expenditure on education, and recommendations to improve the education system today. Within these categories, the most pressing questions I asked were: How disparate are the achievement rates of public versus private school children at the primary and secondary school levels? Where do the disparities in primary and secondary school education persist -- by gender, region, or access to private education? What institutional support exists for public school students? What are the results of governmental interventions in the education landscape? And, finally, what should be addressed immediately to improve the education system and issues of overcrowding and low teacher-pay?

Investigating these questions required me to pull from diverse disciplines, stretching from Economics and Political Science to the Comparative and International Education Society. I relied heavily on searching the UNC library database and JSTOR for academic journals, with the most important criteria I used in selecting my sources being overlap with one or more of my research questions and numerical data sets accompanying the articles' findings. Furthermore, as I found the available literature on education in Egypt limited and mainly focused solely on university education, I made sure to have at least one source with comparative economic data on household expenditure, one that analyzes poverty levels, and one that includes a historical discussion of education under the previous three Egyptian Presidents (Nasser, Sadat, and Mubarak). And although pooling from varying academic fields provided a thorough picture of the state and development of education in Egypt, it was challenging to cohere the evidence I found and their conclusions from such disparate sources to make a core argument for this paper. So, while I found answers to several of my research questions, I was restricted by a topic in Egypt that is not yet fleshed out by the academic field and left with new questions that need to be answered.

Findings, Argument, and Evidence

Coming into my research, I anticipated my findings would show that among the main factors in determining quality of education and success in school achievement would be access to private tutoring -- with the main determinant of that access being household income. Accordingly, I also believed that inefficient government spending decisions and the university placement exams would be part of the biggest cracks in Egypt's education system. While my findings do show a correlation between household income, private schooling, government expenditure on education, and the secondary school examination system on the impact of educational returns on investment and Human Development, these factors are not universal across Egypt. Instead, I was surprised to find that rather than household income being the major determinant of access to education and private tutoring, the biggest factor is region of living. The poor and students generally in rural Egypt have worse public facilities and funding compared to the poor in urban areas.

Consequently, the challenges and remedies for urban students are not all applicable to rural students and communities. Nonetheless, there is one common factor that all of Egypt's Education Development and its weaknesses trace back to: decreased government investment and the deterioration of the welfare system over the time of Presidents Sadat and Mubarak.

Thus, my research leads me to this core argument: since Nasser, Egypt's willingness to industrialize paired with later-implemented neo-liberal economic reforms under Sadat and Mubarak resulted in a decrease in structural attention and funding for education, which in turn led to increasing state-emphasis on technical education fields rather than the university, a boom in informal markets for students to supplement education and teachers to supplement pay, and burgeoning divides in education access and quality between urban and rural areas.

Government Intervention, Liberalizing Budget, and Push for Technical Education

Under President Gamal Abdel Nasser, the government's educational support started out strong. In 1962, higher education became universally free and girls were encouraged to enroll in all levels of education (Mirshak, 43). Yet, with these changes came increasing autocratic exertion over the education system, and Nasser's regime began to make technical education a "core requirement" of his push to industrialize Egypt (Mirshak, 43). Later, in 1974, President Sadat introduced his "Open Door" Policy (Infitah) that liberalized the economy and consequently led the government to "start withdrawing from providing basic services," namely state-supported healthcare and public-school education (Mirshak, 45-47). Simultaneously, Sadat increased spending on his 'New Cities' Program,' which Hosni Mubarak continued and oversaw the building of 20 new cities built between 1990-2010 (Dixon, 42). Between 1997-2001 alone, the New Cities program constituted 22% of Infrastructure investments, while education has been consistently relegated to around 5% of GDP and in 2018 was only 4% (Dixon, 41-42; Mirshak, 41). Not only has funding for public school facilities, teachers' pay, and educational access proportionally decreased as part of overall government expenditure, but previous guarantees of employment for university graduates as part of President Nasser's 1962 education program were phased out right along with the rest of the welfare state as neo-liberal policies took hold in the 1980s

thus diminishing the rate of returns on education and forcing students into an avenue that the government encouraged as it ramped up construction projects and sought to bolster its export economy in the 1980s and 1990s: technical school education (Dixon, 41). The push towards technical school enrollment is interconnected with rising rates of continuing school, lack of improvement in primary school education, the availability of public schools offering academic secondary education versus technical secondary education, and even pressure from the World Bank. For all the faults in Egypt's education system, the evidence I found shows that school enrollment and average grade of school exit has improved, with now the average student finishing all the way through the end of secondary school (Lloyd et. al, 452). Nonetheless, while more students are enrolling in school, Egypt's primary school educational quality has continued to falter -- ranking 133rd globally (World Economic Forum, 2017) and an estimated 50% of students "functionally illiterate after five years of schooling" (Mirshak, 40). Consequently, while more families are supporting their children to continue their studies, poor support for early education has inhibited school performance. This is especially problematic

because the Egyptian government tests students at grade 8, with the test scores used to determine continuation and placement in secondary schools (Lloyd et. al, 450). An increasingly overcrowded and underfunded public education system, paired with competitive placement tests for secondary school and a volatile labor market play right into the Egyptian government's push for technical school education over academic and professional education. Thus, "[a]s a result of the relative availability of these two different types of secondary schools [academic and technical]," an estimated two-thirds of students continued on to technical school in the early 21st century, where there is little-to-no path afterward for higher education (Lloyd et. al, 451). The blame for high technical school enrollment isn't on the Egyptian government alone; at the end of the 20th century and turn of the 21st, the World Bank proposed that

Egypt build more "industrial technical schools" as a valve to diversify school options, combat increasing student enrollment, and bolster the vocational job market (Lloyd et. Al, 451).
Yet, these secondary schools not only encourage students to pursue paths with limited opportunities for mobility and educational breadth, they also don't solve the cracks at the foundation of Egypt's Education system: as of 2013 an estimated 13% of the labor force was illiterate despite universal education, and graduates of technical school education make up 41% of the labor force yet are side-by-side with university graduates in facing the highest unemployment rates (Nassar & Biltagy, 1447).

The Turn and Boom of the Informal Education Market
Poor public educational quality combined with under-funding and uneven systematic government support have heaped the development of students' education onto sacrifices by family households to pay for private schooling and/or private tutoring. Additionally, these factors are also forcing teachers to gravitate towards working as private tutors to compensate for being among the lowest paid civil workers in Egypt (Dixon, 41). Consequently, the movement of educators into private tutoring continues to expand and further reinforce a feedback loop that encourages the government to keep putting off public education support while the country's people and its state of education teeters on a stool with only three pegs to support itself.

The private schooling system can be seen, like secondary technical education, as another alternative to the stagnant quality of public education – but only for the wealthy. Looping back to the New Cities program in Egypt from the 1980s and 1990s, the rise in private schools and universities accompanied the government's diversion of spending away from education and towards construction projects (Dixon, 42). During the heart of Egypt's liberalization and New Cities program, the Egyptian government passed Law 306 in 1993 that officially created the private school system, and can be viewed, like secondary technical education, as another alternative to the stagnate quality of public education – but only for those who can afford it (Dixon, 42). Another part of the informal education sector that spawned because of the deterioration of public education is the Civil Society Organisations (CSOs), although these are volunteer-based groups that "go beyond the confinement of formal education" with teachings in areas such as political and social education and are not a substitute for education across the fields of Math, Science, History, Writing, and Language (Mirshak, 51).

Even so, both public and private students are able to receive support from the informal/private education market by means of private tutoring. As state earlier, almost regardless of income families across wealth brackets pay significant proportions of their household income for their children's private tutoring. In 2005, 56% of families across all of Egypt and 64% of all families in urban centers paid for private tutoring (Mirshak, 43). Furthermore, private tutoring alone accounts on average for more than a one-fifth of a family's spending on budget, which includes families that pay for private schools often costing more than 40,000 EGP per year (Mirshak, 43). In total, compared to the 4% spent on Education investments mentioned earlier, private tutoring services garner almost half of that -- with an estimated 1.6% of GDP additionally spent by families on private tutoring (Mirshak, 41).

Ultimate Educational Disparity: The Urban vs. Rural divide

The decentralized government spending on education, rise in technical school education, and flight of students and educators alike towards informal markets of private education (or formal private schools to those who can afford it) culminate in the starkest pitfall of Egypt's education system that the evidence I found reveals: educational access and quality in urban vs rural Egypt. While lower income brackets still pay for education and tutoring to supplement public education, this mostly only true for urban Egypt -- rural Egypt is marred by higher rates of poverty and proportionally lower government funding for schools, leading to both fewer public avenues for education and restricted ability to pay for private tutoring as a marginal supplement for poor public schooling. In Upper Egypt, where almost the entire region consists of rural communities, an estimated 51% of the population is considered poor (Nassar & Biltagy, 1448) and a family in the lowest income bracket in rural Egypt on average spends over 70% less than the lowest income bracket in Lower Egypt on education for their children (Rizk & Abou-Ali, 10). Of even greater import, Upper Egypt receives the lowest amount of educational funding from the government while Lower Egypt receives the highest allocation of government expenditure on education (Nassar & Biltagy, 1451). Between 2013-2014, Upper Egypt received 2.074 billion EGP compared to Lower Egypt's 6.023 billion EGP investment for public education from the government (Nassar & Biltagy, 1451). There then should be no surprise that the region with the highest rates of poverty and lowest government investment in education also has the highest rates of illiteracy (39.6%), and that 37% of illiterate individuals are poor compared to only 9% of university graduates counting as poor despite the high rates of unemployment that affect both groups (Nassar & Biltagy, 1451). Consequently, poor, rural Egyptians are caught in a cycle of poverty, sub-par education, and thus restricted opportunities for upward mobility and improving their and their future generations' quality of life.

Reflections and Conclusions

Comparing my findings with the benchmarks I set Amartya Sen and Jeffrey Sachs' readings and Goal #4 of the SDGs, Egypt meets the mark in gender inclusivity (Lloyd et. al, 451), universal education, and high enrollment rates, but the quality of the public education system is diluted and deteriorating because of insufficient government funding, low teacher pay and staff shortages, and overcrowding. Egypt clearly falls short of providing equitable education and thus has a major hole in its human development program. The most exigent issue is the urban vs. rural divide and Egypt must immediately provide increased government funding of public schools for its rural populations. If there is educational support for rural populations in Egypt, there is evidence that implies this would help alleviate the high levels of poverty in the rural regions, especially those in Upper Egypt (Nassar & Biltagy, 1451). Yet, the state of Education in rural Egypt is a gaping hole in the quality of life for rural Egyptians and -- in the broader context of

human development and substantive freedoms that Sen outlines -- prevents Egyptians from access to better employment opportunities. This in turn sets-off a domino effect of low basic income and constricted abilities to pay for healthcare, proper housing, and food. Furthermore, Egypt provides an extended exposition on the impacts of state projects of development discussed in our course. In Egypt's case, the New Cities Program was a state-project that the government thought would be the key to modernizing and entering the globalizing world. Instead, it diverted vital funds for educational investment and initiatives like guaranteed-employment for university graduates that were established during Nasser's time, and

in return the New Cities Program offered nothing to improve the quality of life for low- and middle-income Egyptians. Like our study of Julius Nyerere and Tanzania's state-run agriculture projects, the Egyptian government decided based on its own perspective and interests what was best for the nation and did not consult the people on how that money should have been spent nor how at least the New Cities Program could be tailored to address issues pertinent to the majority of Egyptians, such as access to affordable housing, healthcare, retirement, and employment.

Conclusion

While my research produced the conclusions I posit just above regarding education in rural Egypt, it leaves me with several branching questions that I want to investigate beyond this course paper. Since my findings show many urban Egyptians who are poor still pay private tutoring, I would like to know what the other essential areas of their life they are not paying for in order to fund their children's education. Is it healthcare? Retirement? Transportation? Even food?

Subsequently, I have constantly asked myself during the research process what the potential benefits and feasibility of Egypt adopting a welfare-system like the U.S. might be, which includes support for social security, healthcare, unemployment, and affordable housing. As Sachs writes, just marginal increases in development assistance have compounding effects on schooling, heath, living conditions, and general quality of life (Sachs & McArthur, 347-348).

Yet, before exploring these budding questions, a natural extension of my work from this research paper would be to analyze individual classroom environments for students in public schools. One of my research questions for this paper examines the quality of public schools and the academic

support provided inside the school for students. My findings critique the quality of public schools from a macro perspective -- specifically government spending -- yet they and the literature on education in Egypt are missing a micro-level analysis of classroom quality. Thus, if I were to continue with my research

I would address the lack of discourse on the in-school environment, collating quantitative data on overcrowding and availability of textbooks/materials and recording qualitative data on in-school academic support such as after-school programs, counselors, social workers, and peer or teacher tutors/academic support centers – factors I believe are the most important in individual student progression and are not inhibited by household economic background nor regional poverty.

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Political Identity Mediates the Effect of Big Five Personality Traits on Vaccine Hesitancy

Daniel Reich

Abstract

A significant portion of the population is reluctant to get vaccinated for COVID-19 despite the increasing availability of vaccines and growing number of COVID-related deaths. Having such a large portion of the population unvaccinated for a rapidly spreading disease hinders public health efforts in a number of ways. Previous research has shown that Big Five personality traits and political affiliation are significant predictors of vaccine hesitancy. This study utilizes the responses of 164 participants in order to investigate the strength of these predictors through the use of multiple regression. Ultimately, I found that certain big five traits do predict vaccine hesitancy, and that this relationship is mediated by political affiliation

Keywords: Psychology, Personality, Political Psychology, Public Health, Vaccine Hesitancy

Introduction

According to the Mayo Clinic, as of January 2022, only 60% of the population of the United States is fully vaccinated against COVID-19, despite the growing availability of vaccines and increased infections due to new variants. Over the past few years, many variables have contributed to COVID-19 vaccine hesitancy: mistrust in government and/or medical officials (Jennings et al. 2021), religion (Volet et al. 2022) and misinformation (Garret & Young. 2021). However, during the COVID-19 pandemic, vaccination has become increasingly politicized (Bolsen & Palm, 2021). Republican lawmakers have consistently downplayed the necessity of vaccines, and have misinformed their constituents, leading to increased vaccine hesitancy (Jung & Lee, 2021). This reluctance to get vaccinated will ultimately negatively impact unvaccinated individuals, but it also poses a significant risk to public health efforts, more generally.

The drawbacks of having a significant portion of the population unvaccinated include, but are not limited to, longer lockdowns, higher likelihood of new variants, increased risk to immunocompromised individuals, and hospital overcrowding (Gorman et al. 2022). Determining potential causal mechanisms that explain why some individuals refuse vaccination has important public health implications for response to future pandemics.

The goal of this study is to investigate the key predictors of vaccine hesitancy in order to determine potential avenues for combatting it. Previous research has shown that both personality and political affiliation are correlated with vaccine hesitancy. For example, a research team found that right-wing political affiliation is significantly correlated with increased COVID-19 vaccine hesitancy (Gerrettson et al., 2021) and another study found that Big Five Personality traits are significant predictors of whether an individual would support a vaccine requirement in schools (Lin & Wang, 2020). This study will analyze the relationship between personality and vaccine hesitancy, while also focusing on the role of political affiliation in that relationship.

The focus of this study is on the Big Five personality traits and their relationships with political affiliation and vaccine hesitancy. Research conducted by Allport and Odbert in 1936 laid the groundwork for the Five-Factor Model of personality that has become a valuable tool for psychological research. Researchers by the names of McCrae and Costa created the NEO Personality Inventory, which has become one of the primary methods of measuring personality. (McCrae & Costa, 1991). This inventory categorizes participants' responses into five distinct personality traits. Conscientiousness is an individual's ability to regulate their impulses, as well as their likelihood to be more organized and self-disciplined. Extraversion is an individual's tendency to want to interact with others socially, those high in extraversion are highly sociable, while those low in extraversion tend to be more reserved. Agreeableness is related to how people react with others; an individual high in agreeableness is likely to be more trusting and altruistic. Openness to experience pertains to an individual's willingness to be exposed to novel situations and use unconventional thought. Lastly, neuroticism reflects an individual's emotional instability, with higher scores indicating a more emotionally reactive individual. These factors have been shown to affect a large variety of behaviors and ideologies, including vaccine hesitancy. (Roccas et al., 2002). In theory, each of these traits could potentially affect vaccine hesitancy behaviors. A conscientious individual might be more likely to be vaccinated as they tend to be more socially responsible (it is important to note that responsibility is subjective, and that some individuals may not view getting vaccinated as a responsibility), while a more neurotic or emotionally unstable individual might be driven to get vaccinated out of fear. Individuals high in openness to experience might get vaccinated as they are more open to new experiences and ideas, and individuals high in agreeableness might be less hesitant to get vaccinated due to them being more trusting and altruistic.

While those might be viable explanations for how certain personality traits can influence vaccination behaviors, one must also consider confounding variables such as political affiliation. Previous research suggests that there are significant correlations between big five personality traits and political affiliation. Individuals who exhibit characteristics associated with openness to experience, agreeableness, and neuroticism, are more likely to lean to the left politically, while those who exhibit characteristics associated with conscientiousness are more likely to lean to the right (Carney et al. 2008). As mentioned previously, studies have shown that a significant determinant of vaccine hesitancy is right-wing political ideology (Gerretsen et al. 2021). This is important to note, as the relationship between certain personality traits and vaccine hesitancy might be counteracted or strengthened by the individual's political affiliation. I hypothesize that individuals who are more conscientious are more likely to identify as conservative, and thus be more vaccine hesitant. This is might be because conservative politicians have downplayed the necessity of COVID-19 vaccinations, and conservative individuals might not view it as their responsibility to get vaccinated. I also expect to see correlations between the traits of openness to experience, agreeableness, and neuroticism and decreased vaccine hesitancy. I believe each of these traits will independently correlate with decreased vaccine hesitancy, but I expect these correlations to be strengthened by political affiliation, as individuals who identify as liberal are more likely to exhibit these traits, and individuals who identify as liberal are much more likely to be less vaccine hesitant.

Methods
Participants

This study utilizes the responses of 164 participants. Participants were recruited via email, specifically through university listservs. This means that most participants are students at the University of North Carolina at Chapel Hill. It is important to note that this might lead to decreased generalizability, as the sample size is both small, and not completely representative of the rest of the population, but some studies have shown that college student samples are somewhat representative of the rest of the population, although often more homogenous. (Paterson, 2001). Participants were provided with no incentive to participate, and their participation was confidential and voluntary. 28% of respondents were male, 71% were female, and 1% identified as other or chose not to answer. 72% of respondents identified as a democrat, 22% identified as a republican, 6% identified independent or chose not to answer. Consent was received from all participants, and they had the option to withdraw their responses at any time for any reason.

Design and Materials

This study utilized a non-experimental survey design and was conducted using the online survey software Qualtrics. The survey took on average 5 minutes and 43 seconds to complete and contained 26 questions.

The dependent variable in this study was the participant's degree of vaccine hesitancy, specifically regarding COVID-19 vaccines. This was scored on a scale of 0 to 24, with higher scores implying a higher degree of vaccine hesitancy. Vaccine hesitancy was quantified through a series of questions about the participant's vaccine-related behaviors and ideals.

Participants were asked 6 questions wherein they would rate how much they agree with a statement regarding the reliability and effectiveness of vaccines. For example, I asked "To what extent do you agree or disagree with the following statement?: I am concerned with how quickly the COVID-19 vaccines were developed". Participants had the options of: "Strongly disagree", "Slightly disagree", "Neither agree nor disagree", "Slightly agree", and "Strongly agree", with "Strongly disagree" being given a score of 0, and "Strongly agree" being given a score of 4. Their responses to all 6 statements were added together to determine their vaccine hesitancy score ($\alpha = .84$). There are a few independent variables in this study, including some general demographic information, but my main variables of interest were the Big Five Personality Traits of agreeableness, extraversion, conscientiousness, openness to experience, and neuroticism. These traits were scored on a scale of 0 to 12 each, with a higher score indicating a higher prevalence of that specific trait. To get these scores, I asked the participants to rate themselves using the Big Five Inventory (McCrae & Costa, 1991). This inventory includes 3 questions for each of the Big Five Traits. For example, the statement "I am someone who keeps things nice and tidy" is closely related with the personality trait of conscientiousness. These statements were scored in the same way as the vaccine hesitancy questions, with the participants having options ranging from "Strongly disagree" to "Strongly agree". ($\alpha = .74$).

I also included questions regarding the participant's political affiliation. These questions were simply "How would you describe your political affiliation?" (Republican, Democrat, Independent, Other/Prefer not to answer), and "Who did you vote for in the 2020 presidential elections?" (Donald J. Trump, Joseph R. Biden, Other, prefer not to answer). I hypothesize that an alignment with Donald Trump would indicate more opposition to COVID-19 vaccines. The actual political ideology of the participant was not measured.

Using these responses, I will test for bivariate correlations between each personality trait and political affiliation, the personality traits and vaccine hesitancy, as well as the correlation between political affiliation and vaccine hesitancy. I will then conduct two multiple regressions, the first of which will analyze the Big Five traits as predictors of vaccine hesitancy, while controlling for demographic variables, and the other will analyze the Big five traits as predictors of political affiliation, also while controlling for demographic variables. I will conclude by conducting Sobel tests treating Big Five traits as the treatment effect and political affiliation as a mediator to determine if political affiliation mediates the effects of individual Big Five traits on vaccine hesitancy.

Results

Correlational Analysis

An initial correlational analysis found a number of statistically significant predictors for both vaccine hesitancy and political affiliation. Statistically significant predictors for vaccine hesitancy at a .05 level of significance include neuroticism, conscientiousness, income, and political affiliation (Table 1). Higher levels of neuroticism and higher income are both correlated with decreased vaccine hesitancy, while conscientiousness is correlated with increased vaccine hesitancy. Additionally, identifying as conservative is strongly correlated with increased vaccine hesitancy, while identifying as liberal is correlated with decreased vaccine hesitancy. These findings are consistent with my hypotheses, as it shows that some big five traits are correlated with vaccine hesitancy, and conservatives tend to be more vaccine hesitant. Statistically significant predictors for political affiliation include neuroticism, openness to experience, and vaccine hesitancy (Table 2). Neuroticism and openness to experience are both negatively correlated with political affiliation, meaning that individuals high in either of these traits are more likely to identify as liberal. Again, these findings are consistent with my hypotheses that certain big five traits are correlated with political affiliation.

Table 1

Variables	Cor	95% Confidence Interval (Lower Bound)	95% Confidence Interval (Upper Bound)	p-value
Vacc~Neuro	-0.21	-0.36	-0.05	0.011**
Vacc~Cont	0.16	0.00	0.32	0.048**
Vacc~Open	-0.13	-0.31	0.04	0.126
Vacc~Extra	0.01	-0.17	0.18	0.936
Vacc~Agree	-0.15	-0.32	0.02	0.088*
Vacc~Affil	0.63	0.52	0.723	0.000***
Vacc~Sex	-0.07	-0.24	0.11	0.468
Vacc~Income	-0.18	-0.34	-0.00	0.046**

*** P-value less than .001, ** P-value less than .05, * P-value less than .1

Table 2

Variables	Cor	95% Confidence Interval (Lower Bound)	95% Confidence Interval (Upper Bound)	p-value
Affil~Neuro	-0.24	-0.40	-0.07	0.008***
Affil~Agree	-0.16	-0.33	0.02	0.079*
Affil~Cont	0.16	-0.02	0.33	0.073*
Affil~Open	-0.27	-0.43	-0.10	0.002***
Affil~Extra	0.03	-0.15	0.21	0.731
Affil~Vacc	0.64	0.51	0.73	.000***
Affil~Sex	-0.10	-0.27	0.08	0.262
Affil~Income	-0.14	-0.31	0.04	0.117

*** P-value less than .001, ** P-value less than .05, * P-value less than .1

Regression Analysis

My original hypothesis was that Big Five Personality traits were significantly correlated with vaccine hesitancy, and that this correlation was mediated by political affiliation. The first multiple regression analysis with the Big Five traits as the independent variables and vaccine hesitancy as the dependent variable showed that neuroticism was a statistically significant predictor for vaccine hesitancy while controlling for sex, income, and education level (Table 3). This signifies that an individual high in neuroticism is much more likely to be less reluctant to get vaccinated for COVID-19. This regression model was not statistically significant (Adjusted R^2 = 0.07, p = 0.124). Additionally, another multiple regression analysis with political affiliation as the dependent variable also showed that neuroticism and openness to experience were statistically significant predictors for political affiliation with a b of -0.08 and -0.07 respectively, while controlling for sex, income, and education level (Table 3). Interestingly, none of the other big five personality traits were statistically significant predictors of either political affiliation or vaccine hesitancy, while controlling for sex, income, and education. This regression model was statistically significant (Adjusted R^2 = 0.350, p = 0.000).

Table 3

Dependent Variable	Variables	Standardized beta (b)	Standard Error	p-value
Vaccine Hesitancy	(Intercept)	12.39	0.50	0.000***
	Neuroticism	-1.21	0.54	0.025**
	Conscientiousness	0.65	0.53	0.225
	Openness to Experience	-0.23	0.55	0.681
	Extraversion	-0.62	0.56	0.263
	Agreeableness	-0.45	0.59	0.444
Political Affiliation	(Intercept)	0.15	0.03	0.000***
	Neuroticism	-0.08	0.03	0.019**
	Conscientiousness	0.05	0.03	0.122
	Openness to Experience	-0.07	0.03	0.042 **
	Extraversion	-0.03	0.03	0.454
	Agreeableness	-0.03	0.04	0.487

*** P-value less than .001, ** P-value less than .05, * P-value less than .1

Sobel Test for Mediation

To evaluate possible indirect effects involving Big Five personality traits, I conduct Sobel tests treating Big Five personality traits as the treatment effect and political affiliation as a mediator. The results of the Sobel Test show that political affiliation is a statistically significant mediator for the relationship between neuroticism and vaccine hesitancy (z = -2.58, p = 0.009). With a p-value of less than .05, I can reject my null hypothesis and assume that this mediation effect is statistically significant. Additionally, a separate Sobel Test shows that political affiliation is also a statistically significant mediator for the relationship between openness to experience and vaccine hesitancy (z = -2.95, p = 0.003). These results suggest that an individual's personality somewhat contributes to determining their political affiliation and an individual's political affiliation contributes to their level of vaccine hesitancy, thus, personality ultimately contributes to an individual's level of vaccine hesitancy.

Political Affiliation and Vaccine Hesitancy

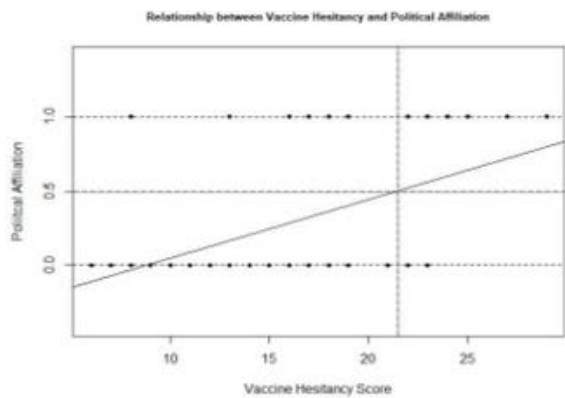A bivariate logistic regression analysis of political affiliation and vaccine hesitancy showed that political affiliation was a moderate and statistically significant predictor of vaccine hesitancy (b= 10.18, R^2= .40, SE = 1.12, p= .016). Further analysis showed that after an individual reaches a vaccine hesitancy score of 21, they are more than 50% likely to identity as a republican, as opposed to a democrat. (Fig 1)

Figure 1.

Relationship between Vaccine Hesitancy and Political Affiliation

Discussion

I hypothesized that certain big five traits are correlated with vaccine hesitancy. The traits that I predicted would be correlated were conscientiousness, openness to experience, agreeableness, and neuroticism. I found that conscientiousness is positively correlated with the vaccine hesitancy, while neuroticism is negatively correlated with vaccine hesitancy. Additionally, I hypothesized that these traits would also be correlated with political affiliation. My results show that neuroticism and openness to experience are negatively correlated with conservative identity. I also expected political affiliation to be strongly correlated with vaccine hesitancy, with conservatives being more vaccine hesitant, which my results support. Moreover, when combined into a regression analysis, only neuroticism is correlated with decreased vaccine hesitancy, while neuroticism and openness to experience are both negatively correlated with conservative identity. Lastly, the results of the Sobel tests show that political affiliation is a statistically significant mediator for both the relationship between neuroticism and vaccine hesitancy, as well as the relationship between openness to experience and vaccine hesitancy.

These findings are mostly consistent with previous research in that Big Five traits are correlated with both vaccine hesitancy and political affiliation. For example, my findings support the connection between vaccine hesitancy and conservativism as found by Gerretsen et al. Additionally, my findings also support the findings of Carney et al. which state that individuals high in conscientiousness will be more likely to identify as conservative, and that individuals high in neuroticism and openness to experience are more likely to identify as liberal. On the other hand, my findings contradict previous studies in one key aspect. My findings did not support those of Carney et al. in that they found openness to experience to be a key predictor of political affiliation and it was insignificant in my study.

There are a number of implications of this study. My results contribute to current knowledge about the relationships between personality and political affiliation, as well as the relationship between political affiliation and vaccine hesitancy. My study also revealed that a significant portion of the relationship between neuroticism and vaccine hesitancy, as well as the relationship between openness to experience and vaccine hesitancy, is mediated by political affiliation.

There are also a few limitations to this study. As the sample size is quite small, the findings are probably not very generalizable. Additionally, since all of the participants are college students, there might be less variability than there would be in the general population. Furthermore, college students have been found to have similar levels of each of the big five traits (Peterson, 2001), which could decrease the strength of the correlates.

Future research could analyze other confounding variables and study the general population as opposed to just college students. Additionally, there are many other policy-related areas that could be detrimentally affected by the same sort of politicization. For example, whether or not individuals support affirmative action programs, planned parenthood, or common core education could all potentially be somewhat predicted by personality traits and political affiliation.

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Humanities

Meet the author:

Nick Tutwiler is a third-year student from Charlotte, North Carolina. He is currently pursuing a history major (American history concentration) and a music minor. His research interests include social history, 19th century American history, the history of European imperialism, Islam, and African History. He enjoys analyzing primary sources of cultural and social history and shedding light on the lived experiences of people in the past. In his coursework as a history student, he developed an interest in imperialism, African decolonization, and Islamic history. He wanted to learn more about how subjugated people responded to imperialism and the lived experiences of decolonization - especially in Africa. This paper developed from a AAAD course on Islam in Contemporary Africa that provided him the opportunity to pursue his interests. Learning about the lived experiences and rich culture of African Muslims along with the history of Islam in Africa inspired him to understand the intersection of Islam and African decolonization. He plans to pursue a career in history education.

A Comparative Analysis of African Liberation Discourse Among Islamic and Secular Pan-Africanist Leaders

Nicholas Tutwiler

Abstract

 This paper compares the African post-colonial visions of Islamic and secular decolonization leaders through the lens of Pan-Africanism. It argues while both Muslim and secular decolonization leaders subscribed to Pan-African unity, Islamic Pan-Africanists emphasized the unifying force of Islam for Muslim Africans and advocated for Islamic political inclusion in post-colonial Africa; alternatively, secular Pan-Africanists de-emphasized the unifying role of Islam in favor of political and economic unification. Despite this conflict, Pan-Africanists, such as Kwame Nkrumah, developed the post-colonial philosophy into a holistic model of decolonization that reconciled the two competing visions and generated solidarity against imperialism. Lastly, this paper examines the Pan-African philosophies of Shaykh Ibrahim Niasse, Gamal Abdel Nasser, Julius Nyerere, and Kwame Nkrumah to demonstrate the intersection of Islam and Pan-Africanism.

Introduction

 This paper explores the role of the socio-political relationship between Islam and Pan-Africanism in shaping the discourse of African decolonization leaders. Moreover, it compares the competing visions of African unity by Islamic and secular Pan-Africanists. Lastly, it answers the following questions. What was the role of Islam in shaping decolonization and post-colonial African unity and liberative discourse, and how did it differ from secular Pan-Africanism? How did Islamic and secular Pan-Africanists hope to achieve African political, cultural, and economic unity for nation building in the post-colonial period?

 While both Muslim and secular leaders subscribed to Pan-African, Islamic Pan-Africanists emphasized the unifying force of Islam for Muslim Africans and advocated for Islamic political inclusion in post-colonial Africa. Alternatively, secular Pan-Africanists de-emphasized the role of religious unity – in the form of Islam – in favor of trans-national political, economic, and cultural factors. Despite this conflict, the discursive intersection of Pan-Africanism and Islam provided a theoretical, holistic model of African decolonization that reconciles the competing secular and Islamic visions and generates solidarity against imperialism.

First, this paper analyzes the post-colonial leadership of the Senegalese Sufi leader Shaykh Ibrahim Niasse as a model of Islamic Pan-Africanism. Then, it compares Niasse's Islamic Pan-Africanism to the Pan-Islamism of Gamal Abdel Nasser and his vision for post-colonial African unity. Then, it examines the secular leadership of Tanzania's Julius Nyerere, who subscribed to a regional, gradual approach to Pan-Africanism. Finally, it addresses Kwame Nkrumah's comprehensive vision of Pan-Africanism and African political unity, his relationship with Niasse, and his philosophy of Consciencism as a syncretic model that incorporates Islam into post-colonial African politics and culture.

haykh Ibrahim Niasse and Islamic Pan-Africanism

 Historically, African nationalism and anti-imperial empowerment characterized the relationship between Islam and Pan-Africanism. For instance, in 1912, Duse Mohamed Ali - a Sudanese-Egyptian, Muslim Pan-Africanist and a forerunner to Marcus

Garvey - published the African nationalist *African Times and Orient Review* claiming it would, "present the truth about the African and Oriental condition." Mohamed Ali demonstrates the clear relationship between indigenous Africans' Islamic identity and African empowerment against imperialism. However, rather than emphasizing spiritual leadership through Islam, Mohamed Ali's vision was Islamic cultural and political leadership based on unification through identity.

Alternatively, Niasse's vision of Muslim leadership in the post-colonial era advocated the cultural, religious unity of Islamic Pan-Africanism for African Muslims and the trans-national leadership of Africans in the decolonization era as examples of morally righteous, anti-imperialists. Niasse believed Islam accomplished this unity through the spiritual authority and the expansive presence of Islam in Africa as a moral guide for its adherents. In turn, Niasse employed his relationship with Pan-Africanist and secular leaders to protect Islamic identity in the political sphere and secure African Muslims' role in uplifting and leading post-colonial Africa. Guiding Niasse's vision was his core belief in the trans-national spiritual flood (Fayda) of Islam that he believed "will reach wherever the land reaches."

At the heart of his belief in Islam's role in African moral uplift was the role of Muslims as the leaders of mankind. He proclaimed, "God helps the servant as long as the servant is helping his brother . . . we [Muslims] become the best of communities brought forth for mankind."

Niasse's trans-national approach to Islam - through Fayda - and his belief in the centrality of Islam to communal leadership, allowed him to co-opt the transnational rhetoric of Pan-Africanism and advocate for the political and cultural power of Muslims in Senegal and Africa during decolonization. This spiritualism reorientated the relationship between Islam and Pan-Africanism in decolonization discourse from strictly African nationalism and liberation to Islam as a force for post-colonial, cultural unity around the fundamental tenants of spirituality, empathy, and morality.

Gamal Abdel Nasser's Pan-Africanism and Pan-Islamism

Gamal Abdel Nasser converged Pan-African and Pan-Islamic unity to define his post-colonial vision for Egypt. Nasser - a friend of Niasse and Kwame Nkrumah - emphasized the role of Egypt's African and Islamic identities in reclaiming Egyptian culture and resisting neocolonialism across the continent. In the wake of Egyptian liberation from imperialism after the 1952 coup and the neocolonial Suez Crisis of 1956, Nasser recommended Egypt reclaim three circles of national identity: Arab, African, and Islamic. In Pan-Africanist rhetoric, Nasser proclaimed, "We cannot stand aside in face of what is taking place in Africa [wars of decolonization and neocolonial economic intrusion] on the assumption that it does not concern or affect us"; Nasser also urged Pan-Islamist orientation around "the circle of our brethren in faith who turn with us, whatever part of the world they are in, towards the same Qibla in Mecca, and whose pious lips whisper reverently the same prayer." For Nasser, Islam asserted Egyptian control over cultural and religious identity that colonization denied and neocolonialism subverted.

Like Duse Mohamed Ali, Nasser appealed to the cultural identity of Islam to unify Egypt against colonialism not only because of its value as an indigenous resistance to foreign cultural repression, but as a trans-national source of political and spiritual empowerment. Moreover, Nasser employed Pan-Africanist rhetoric to reclaim Egypt's African identity and champion its role in supporting decolonization across Africa because colonialism anywhere in Africa threatened Egyptian sovereignty with the possibility of neocolonial political and economic intrusion. Nasser's integration of Pan-Africanist and Islamic religiosity as an anti-imperialist framework reconciles the Islamic nationalism of Druse Mohamed Ali and the religious leadership of Niasse. This cohesive philosophy of Islamic Pan-Africanism emphasizes the vital role of Islam in cultural unification for nation-building in post-colonial Africa and in trans-national political

solidarity against imperialism and neo-colonialism. In essence, Islamic Pan-Africanists advocated for the Muslims of Africa to be recognized for their socio-cultural and political value as Muslims and Africans during the political tumult of decolonization.

Julius Nyerere: Secular Pan-Africanism and the State

Islamic Pan-African discourse responded to the political, cultural, and anti-colonial framework of secular Pan-Africanists. This framework of Pan-Africanism is "an ideal and movement designed to regroup and mobilize Africans in Africa and the diaspora against racial discrimination, foreign domination and oppression, and economic exploitation" that politically resists colonialism and neocolonialism and culturally reclaims "Africa's heritage, history, culture, traditions, and value." Within this framework, Tanzanian president and decolonization leader Julius Nyerere's Pan-Africanism differed from Kwame Nkrumah's political integration; this stemmed from his belief in unifying the multi-cultural, complex ethnicities of Africans gradually through measured political integration that accounted for individual state sovereignty. As a result, Nyerere's approach to African unity implicitly dismissed the significance of cultural and religious unification through Islam. The transnational political empowerment afforded to Islam counteracts the regional and state sovereignty approach to African solidarity.

Moreover, Tanzanian nationalism, socialism, and state power motivated the Pan-Africanist philosophy of Nyerere. As a leader of decolonization, "Nyerere perceived the state as the agency both for nation-building and economic development" and for unifying and organizing society in the wake of imperialism. Nyerere's belief suggests secular Pan-Africanists differ from Islamic leaders because their approach emphasizes unitary political power as the principal mode of anti-imperial unification - not the decentralized spiritual or cultural identification advocated by Niasse. Niasse advocated for Islamic political inclusion in post-

colonial institutions precisely because of the secular exclusion of Islam in Pan-Africanist development by leaders such as Nyerere. While both advocated for varying degrees of African post-colonial unity to resist imperialism and neocolonialism, the point of contention between Islamic and secular Pan-Africanism was state politics and power over sovereignty.

Kwame Nkrumah: the Syncretism of Consciencism

In contrast to the gradualism of Nyerere, Nkrumah advocated centralized political integration of all newly liberated nations in Africa. On the day of Ghana's independence he proclaimed, "we again rededicate ourselves in the struggle to emancipate other countries in Africa, for our independence is meaningless unless it is linked up with the total liberation of the African continent." Nkrumah hoped to secure Pan-Africanist, continent-wide liberation through a political union: the United States of Africa; he reasoned, "the African race, united under one federal government, will emerge not as just another world bloc to flaunt its wealth and strength, but as a Great Power." Nkrumah saw a trans-national political Union as the only method of combating neocolonialism and securing African liberation. Nkrumah and Niasse maintained a close personal relationship. However, Niasse employed his relationship with Nkrumah to further his own vision of Islamic Pan-Africanism in which he urged Muslims to "liberate themselves and raise the pan-African banner, so that they may practice their beliefs and traditions freely." The political integration advocated by Nkrumah contextualizes his philosophical framework detailed in Consciencism and his model accommodates the Islamic liberation and freedom of Niasse.

Kwame Nkrumah's Consciencism is a syncretic model that reconciles the political contention between Islamic and secular Pan-Africanism. Moreover, it accommodates Islam into post-colonial culture and grants it a vital role in defining post-colonial identity that respects its agency. Cultural unification is the center of Nkrumah's philosophy.

He argued his framework of Consciencism supplied the opportunity for African post-colonial political and economic progress through "the disposition of forces which will enable African society to digest the western and the Islamic and the euro-Christian elements in Africa, and develop them in such a way that they fit into the African personality."

Nkrumah's philosophy is the framework that allows Islamic and secular Pan-African unity to coexist and cooperate in the political sphere because it merges Islamic, European, and indigenous African identities into a syncretic culture that unites disparate African identities and dismantles sectionalism. Nkrumah's philosophical framework orients cultural unification around the goal of African political sovereignty, which incorporates the philosophy of secular Pan-Africanists such as Nyerere. However, the tension between Nyerere's national sovereignty and Nkrumah's trans-national political union remained, despite Consciencism's cultural unification and African political empowerment.

Niasse advocated Islamic inclusion in state politics and national leadership as a means of protecting the sovereignty of African Muslims. Like Nasser's philosophy, Consciencism's inclusive cultural framework does not deny sovereignty to Muslims, but, rather, views their cultural and religious value as indigenous and significant to the Pan-Africanist conception of African identity. Finally, central to this philosophical framework is liberation from imperialism. In addition to cultural unity for nation building, Consciencism allows Islamic Pan-Africanism to equate religious liberation with the political liberation of Africans from imperialist cultural repression. Consciencism accepts the innate cultural value of Islam to African identity and translates that innate identity into anti-imperial and anti-neocolonial resistance.

Conclusion

Islamic and secular Pan-African leaders professed the unity of African anti-imperialism.

Their discourse emphasized cultural and political liberation through trans-national solidarity against imperial intrusion.

Their discourse emphasized cultural and political liberation through trans-national solidarity against imperial intrusion. However, Islamic Pan-Africanists urged secularists to recognize the nationalistic and spiritual unity of African Islam as a source of liberative empowerment. Yet, secular Pan-Africanists, like Julius Nyerere, de-emphasized cultural and spiritual unification in favor of trans-national political and economic partnership and state sovereignty. In contrast, Islamic Pan-Africanists, like Niasse, desired political inclusion in post-colonial institutions to ensure African Muslims' cultural and spiritual sovereignty. Kwame Nkrumah's philosophy of Consciencism reconciled this dissonance and oriented African cultural unity around indigenous African, Islamic, and European identities; in turn, it discouraged cultural and political conflict and generated solidarity against imperialism. In liberative discourse, this approach welcomed the cultural unification of Islamic Pan-Africanism and established Islam as a significant force for defying imperialism in cultural reclamation and political advocacy - central tenants of Pan-African thought.

Though Consciencism's theoretical framework evidences the potential for Pan-African philosophical solidarity, Pan-African unity succumbed to political fragmentation and balkanization in the post-colonial period. The political union of Nkrumah failed to materialize because of independent African leaders (such as Nyerere) who hesitated to relinquish their individual sovereignty in favor of a trans-national political entity and the neocolonial subversion of African unity by hegemonic traditional imperialist powers. However, despite the historical failure of Pan-Africanism as a force for political unity, the philosophical unity and liberative discourse espoused by Niasse, Nasser, Nyerere, and Nkrumah highlights the significance of Pan-African thought as a nation-building, liberative force for African solidarity with great potential in contemporary Africa. At the intersection of Islam and state politics in Africa, the Pan-Africanism of the decolonization era provides a lesson in the optimistic possibilities of African identity, independence, and solidarity.

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Earhart's Final Hours: Life, Disappearance, and Legacy

Alexandra Carmack

Introduction

Amelia Earhart was a hero of her time. A trailblazing pilot who set aviation records left and right, Earhart also made advancements for women in a way that few had been able to before due to her status as a public icon. On July 2, 1937, Earhart took off in her Lockheed Electra for the last time from Lae, New Guinea, leaving for the last leg of her circumnavigation of the globe.[1] Her navigator, Fred Noonan, was tasked with ensuring that they made it to their next destination, Howland Island.[2] It would be dark at their expected arrival time, so, it was imperative that their calculated route flew them close enough to the island to see the lights of the U.S. Coast Guard cutter, the Itasca, which would be awaiting their arrival to guide them in and ensure a safe landing on the small, uninhabited island.[3] In an unexpected turn of events, Earhart and Noonan would never arrive at Howland, prompting a massive search-and-rescue mission for the missing persons. Eventually, the U.S Navy released a report stating that the aviators' cause of death was drowning, after making the assumption that they ran out of fuel and subsequently crashed into the ocean.[4] Since the release of the report, there has been mass speculation and debate regarding Earhart and Noonan's true cause of death. The looming question is: what really happened to Amelia Earhart? One argument states that Earhart and Noonan crashed into a remote, nearby island called Nikumaroro (Gardner Island at the time), and lived out their final days there, based on decades of accumulated evidence.[5] The other side argues in favor of the contents of the initial Navy report: Earhart and Noonan crashed into the Pacific Ocean and drowned, and any argument to the contrary is nothing more than a baseless conspiracy.[6] This paper will examine each side of this historical debate, and ultimately determine which thesis holds more merit based on their claims, evidence, and logic.

Ocean Crash Theory

The original, most widely accepted theory is that Noonan and Earhart crash-landed into the Pacific Ocean after failing to find Howland Island and running out of fuel, as was reported by the United States Navy and Coast Guard.[7] For the sake of this argument, the original report from the U.S. Government and the evidence it presents will primarily be used, along with arguments from Long, Brink, and Jameson. While this thesis is not Brink and Jameson's primary argument, they do present logic explaining the basis behind the theory. Elgen Long was a master pilot who won an FAI Gold Air Medal award and was an avid researcher of Amelia Earhart and her disappearance, even developing his own "Crash and Sink" theory.

The majority of the backing for this theory revolves around one central concept: the other side simply does not have evidence to prove that their theory is true, so this one must be true. For example, the radio transmissions that are said to have been broadcast by Earhart after the estimated time of the crash cannot be traced back to her with complete certainty. In the days following the crash, reports of "carrier waves" (radio signals) in the vicinity of Howland island arose, as reported by the U.S. Coast Guard.[8] Additional SOS messages were picked up, centering around the Phoenix group of islands southeast of Howland, which is in the direction of Nikumaroro.[9]

This is also the direction that friends and colleagues of Noonan knew he would head in the event of an emergency.10 Despite how promising these leads were, by the time the search reached this area there was no evidence found of the Electra, Earhart, or Noonan being there.11 According to Long: "...the incessant calls of the Itasca, calling KHAQQ and Earhart by name, were being broadcast indiscriminately to most of the Pacific and a good part of the world. Dozens of people, having just heard the name 'Earhart' or 'KHAQQ' over their receiver, sent reports of having heard her. Some even claimed to have messages sent in Morse code by Earhart or messages of her reported position where no land or island existed."12

According to supporters of this argument, it is impossible to know if a true radio broadcast from Earhart was heard, and the reports were likely just the result of frenzied aviation enthusiasts, no more than conspiracists. Further, when questioned by the crew of the Itasca, residents of two nearby islands, Arorai and Tamana, claimed that they neither heard nor saw the plane come down.13 Therefore, it is not likely that Earhart and Noonan ended up on the islands in the direct vicinity of Howland.

A strong supporting factor of this argument is that government-reported strong headwinds, heavy weather, and low visibility would have made it extremely difficult for Earhart and Noonan to 1. make it to Howland Island without running out of fuel which would be drained from fighting headwinds, and 2. spot the island when/if they finally did arrive.14 According to the U.S. Navy's report, the most likely courses that Noonan would have taken in an event of predicted early-morning low visibility from the east were either overcorrecting southward running up a morning longitude through the target or overcorrecting northward to run down a

morning longitude through Howland Island.15 However, both of these options would have placed the aviators over the open ocean if they overshot their target, which would be catastrophic in the event of a premature gas shortage.16If there truly were strong headwinds and heavy weather as the Navy reported, they would have few other pieces of land to retreat to if they could not find Howland. In fact, Navy Lt. Warren W. Harvey stated that "If Miss Earhart entered the storm, she hadn't a chance."17 The Navy's report claims that stronger headwinds than expected were experienced, and it is estimated that the pair flew at an average of about 110 knots.18 The recommended speed for the flight was approximately 130 knots, which would have the pair arrive soon after the sun had come up but after the immediate daybreak to avoid visibility problems.19 Earhart and Noonan were slightly behind schedule, but it is unlikely that this caused any major concerns regarding fuel, since they were just short of the recommended speed. However, if the pair spent too much time searching for the island, it is possible that fuel became a concern.

In fact, researchers know for certain that Earhart and Noonan were concerned about running out of fuel; she said so herself in her last hour of broadcasting.20 According to Long and the Charter Report from Lae, New Guinea, Earhart's plane was filled with 1,100 U.S. gallons the day before takeoff.21 However, it was 88 °F and sunny in the daytime, which affected the 87-octane fuel's density and caused an estimated reduction by expansion and venting to an equivalent 1,092 standard 6-pound U.S. gallons (fuel expands and weighs less per gallon at

higher temperatures).22 So, the calculation of flight endurance based on a standard 6-pound gallon may have been skewed according to Long.23

An hour and a half after Earhart's correspondence with Captain Thompson regarding her supposed concern over fuel he sent a message to the San Francisco division saying "EARHART CONTACT 0742 REPORTED ONE HALF HOUR FUEL AND NO LANDFALL . . ."24 The Itasca departed to search to the northwest on line 157 337 degrees a half hour later. Earhart's last transmission to the ship at 0843 had stated that they were traveling up and down line 157 337, which runs northwest to southeast through Howland Island, in an attempt to find land and the Itasca.25 Nikumaroro (then called Gardner Island) also sits on this line. Not only does this mean that Earhart was very much still aloft a full hour after Thompson reported her claiming to only have a half hour of fuel left, but it also presents Nikumaroro as a very real possibility for an emergency landing site, lying directly on the path she and Noonan were traversing. This is cause for some of the suspicion leading to the second theory.

Nikumaroro Theory

The other, more hopeful side of the historical debate regarding Earhart and Noonan's ultimate whereabouts believes that the two landed on Nikumaroro, a small coral atoll southeast of Howland, rather than crashing into the sea. Earhart was not known to give up, and Fred Noonan's wife even stated that he would turn back if in doubt rather than ditch the Electra in the sea.26 According to Earhart's close friends, she claimed that if she could not find Howland Island,

then she would attempt to land on a nearby island with fresh water on it.27 Representing this side of the debate will be Jameson, Jantz, and King. These authors, along with other subscribers to this theory, argue that Erahart and Noonan were attempting to find Howland Island, but struggled due to early-morning visibility problems. So, they ultimately elected to land on another island along the line that they were traversing, 157 337.

As to the claim of adverse weather conditions, there is little-to-no evidence that there was any sort of storm or heavy weather upon Earhart's arrival to the area surrounding Howland Island, nor did she mention this in her transmissions.28 Researcher Rollin Reineck even goes so far as to claim that the story of serious weather problems was completely fabricated by the navy to explain Earhart and Noonan's disappearance.29 Additionally, the University of Hawaii's meteorological reports near Howland Island at the time showed that conditions were suitable for flying, and Jameson claims that "Harvey's descriptions of snow, sleet, and ice in the area were incorrect. He was either provided with this information to broadcast or ordered to manufacture it himself."30 So, there is a great deal of doubt surrounding the argument of adverse weather conditions. As for visibility concerns, Leo G. Bellarts, chief radioman on the Itasca, said that no such problems existed, claiming, "As to the weather, there were puffy clouds to the northwest but plenty of blue in between them. Other than that, it was a very clear day."31
Another point on the position of an emergency landing on Nikumaroro is that there was

simply no evidence pointing toward the other theory, a plane crashing into the water surrounding Howland Island. Further, Nikumaroro was not searched because it was not in the radius of the Navy and Coast Guard's search and rescue. The search team focused their efforts toward the southwest of Howland based on wind and sea current directions since they assumed the aviators would be in the water, but Nikumaroro is southeast of Howland.32 This search turned up no evidence of a downed plane, oil slick, crash debris, etc.33 According to Jameson, "there exists no evidence that points to the notion that Earhart and Noonan were anywhere near Howland Island when they came down."34 The plane would have floated if it came down into the water mostly undamaged due to the engineering of the fuel tanks.35 However, in the instance of a crash landing on an Island such as Nikumaroro, the Electra likely would have taken substantial damage causing the fuel tanks to be punctured, which would have allowed for the plane to sink.36 Just offshore of Nikumaroro are massive underwater cliffs, which, if the plane was carried out by the coral atoll's dramatic tide changes, could allow for the plane to be swept away deep and far out into the ocean. Additionally, the Navy reported that "the plane's radio power supply was so located that it could not have been used with [the] plane on the water."37 So, considering the numerous reports of transmissions and carrier waves from Earhart after her disappearance, it is unlikely that she was broadcasting from the water according to this theory.

hypothesis, because except for the victims of the Norwich City wreck, about whom we have no data, no other specific missing persons have been reported."51

If the bones did not belong to Amelia Earhart, they belonged to someone very similar to her. Despite the fact that the bones were lost, the fact that they once existed and were scientifically evaluated is a very strong piece of evidence supporting the theory that Earhart and Noonan landed on Nikumaroro island and lived out their final days there.

Another compelling piece of evidence supporting the Nikumaroro theory is the archaeological excavation that TIGHAR carried out. They found a great number of artifacts on Nikumaroro Island strongly implying that "a woman from the United States lived and died [there] in the late 1930s."38 The artifacts found included but were not limited to a compact mirror with early 20th-century rouge consistent with one Earhart is shown holding in photographs, a small jar containing mercury-based freckle fading cream (Earhart was known for her freckles), and a snap fastener consistent with those which would have been part of a Tabloid first aid kit, which was documented to have been aboard the Electra.39 Additionally, a U.S. zipper pull was found, and after examination it was determined that it was made between 1933 and 1936. This put to rest claims that the belongings were those of a victim of the SS Norwich City shipwreck, which crashed into Nikumaroro in 1929.40 Also among the findings was a heel from a woman's shoe which Earhart was known to wear, along with a "tiny piece of aluminum foil with lettering on it that, while sparse, is consistent with that of an American signal torch, and whose unmarked side exhibits traces of sulfur (67%), silicon, zinc and iron consistent with flammable black powder."41 Lastly, a wooden, dovetailed sextant box was found.42 According to King, Noonan used a nautical sextant similar to the one found as a backup instrument when navigating Pan American or Pacific routes.43 A photo of the navigation room in a Pan Am Clipper Noonan served on shows a Brandis sextant box, the same kind that was found on Nikumaroro.44

Arguably the most supportive piece of evidence toward the Nikumaroro theory is the set of bones found on the island. In 1940, skeletal remains were found on Nikumaroro Island.45 They were immediately examined by Dr. D. W. Hoodless in Fiji and concluded to be male, ruling out the possibility that they belonged at Amelia Earhart.46 The remains were subsequently lost.47In

the following years, people have questioned Hoodless's arguably outdated methods of determining the bones as those of a stocky male. In 2018, Jantz conducted a statistical study using the measurements taken by Hoodless of the bones and compared them to Earhart's measurements. He then cross-referenced these with the average measurements of other possible individuals that could have stumbled upon Nikumaroro Island. Of the sample population, Jantz found that "2,758 (99.28%) individuals have a greater distance from the Nikumaroro bones than Earhart, but only 18 (0.65%) have a smaller distance."48 So, he concluded that "the Nikumaroro bones are at least 84 times more likely to belong to Amelia Earhart than to a random individual who ended up on the island."49 Earhart was more similar to the bones than the majority of random individuals. It is possible that Hoodless mistook the robust tibia and narrow hips he was presented with as those of a stocky male without considering that they might have belonged to a tall, narrow-bodied female such as Earhart.50 The bones may have truly appeared male to Hoodless, but he simply did not have the technology to look deeper into it. Ultimately, Jantz concurs:

"From a forensic perspective the most parsimonious scenario is that the bones are those of Amelia Earhart. She was known to have been in the area of Nikumaroro Island, she went missing, and human remains were discovered which are entirely consistent with her and inconsistent with most other people. Furthermore, it is impossible to test any other

hypothesis, because except for the victims of the Norwich City wreck, about whom we have no data, no other specific missing persons have been reported."51

If the bones did not belong to Amelia Earhart, they belonged to someone very similar to her. Despite the fact that the bones were lost, the fact that they once existed and were scientifically evaluated is a very strong piece of evidence supporting the theory that Earhart and Noonan landed on Nikumaroro island and lived out their final days there.

As far evidence, the original theory that Earhart and Noonan crashed into the Pacific after running out of fuel searching for Howland Island mostly argues that the converse side simply does not have enough evidence to be true. However, this side actually has less tangible evidence than the other backing its theory. Perhaps the strongest piece of evidence toward their argument is using the radius in which they would be able to clearly hear Earhart's transmissions on the Itasca and comparing this with the estimated amount of remaining fuel the Electra would have had. This would give them an idea of how far she could have gotten from Howland Island before having to make a crash landing on a nearby island or ditching the plane into the ocean. This was used to create a search radius for Noonan and Earhart after their appearance. However, the only other island within this radius was Baker Island, which was searched but contained no evidence of a crash. So, the search team continued hunting the ocean in the opposite direction of Nikumaroro island, which was outside of their search radius (400 miles away from Howland). But, there is no way of knowing how much gas was truly left in the Electra, as shown by Earhart

transmitting on her radio a full hour after Captain Thompson reported that she had only a half hour of fuel remaining. Evidence pointing to storms and adverse weather conditions was also disproven.

Logically, this thesis argues that their theory must be the more likely option since there was not much proof at the time backing the Nikumaroro theory. However, this has become untrue in recent years as more evidence has turned up. Additionally, their argument that the bones found on Nikumaroro belong to a stocky male has also been uprooted. Their evidence does not support their logic: adverse weather conditions, fuel shortages, and bone analysis theories have all had logical holes poked in them. There is and was no tangible evidence pointing toward an ocean landing, but there is evidence supporting an emergency landing on Nikumaroro. The only other logical point that may support their theory is arguing that there may have been inconsistencies in Hoodless's bone measurements, especially since the remains were later lost. The measurements of Earhart were also made based on estimates, but these used photographs, sizing of her clothing, and other records, so it was at least very close to her true measurements.

The evidence supporting the Nikumaroro thesis is quite strong. This side uses artifacts found in an archaeological excavation at Nikumaroro, including bones extremely similar to the measurements of Amelia Earhart, to support its claims. This side of the argument presents more tangible evidence supporting its claims, whereas the other side relies on implicit logic which can not be proven and has been often disproven This side uses deductive reasoning, based on their evidence, to produce logical theories. For example, the presence of a lifeboat and oars on the plane (shown by evidence) means that it is very likely that.

Noonan and Earhart would have gone for it in the case of a water landing, especially since the plane would have likely been floating (also supported by evidence). In this case, the pair would have likely been found in the U.S. Navy and Coast Guard's search since they would be fairly close to Howland Island according to the other side's theory. However, this did not happen. Noonan and Earhart most likely would not have abandoned their position if they had already found land, logically supporting the theory of an island landing outside of the Navy's search radius, especially on one that lies on their known path. The majority of this side's logic is backed by evidence, making it the stronger thesis.

Conclusion

Arguably the most famous aviator of her time, Amelia Earhart's disappearance shook the world. In the years following, her true cause of death sparked massive historical debate. One side argues in favor of the Navy's initial report: Earhart and Noonan ditched their plane into the sea after running out of fuel searching for Howland Island. The other believes that they ended up on Nikumaroro Island, where they lived out their final days. A detailed analysis found that there is far more evidence pointing toward Earhart being on Nikumaroro Island than there is of her not. The Nikumaroro argument is logically stronger and supported by more evidence, with Jantz's 2018 bone analysis providing groundbreaking affirmation. While the ocean landing theory does make a relatively strong point based on fuel estimates in the Electra's final hours, these are ambiguous and easily challenged. The mysterious and tragic disappearance of Earhart and Noonan may remain unsolved, but their influence on aviation and women's rights can not be overshadowed by the enigma and chaos of their demise.

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Meet the author:

Hi! My name is Sanjana Nalla and I am a first-year student at UNC intending to double major in Biostatistics and Computer Science with a minor in Philosophy. My broad interests include epidemiology, data science, and 20th-century philosophical movements. Additionally, I am passionate about increasing mental health awareness and aiding in destigmatization efforts.

Existentialism and its Implications on Society

Sanjana Nalla

Introduction

I remember watching Jackie, a movie about how Jacqueline "Jackie" Kennedy Onassis handles the funeral and aftermath of President John F. Kennedy's assassination when it first came out in theaters. There was one moment in the film that intrigued me in particular where Jackie speaks with the priest of Camelot. In this scene, the priest responds to Jackie's queries in a striking manner. He claims that there comes a moment where we all realize that there is no meaning and when we arrive at this conclusion, we will do one of three things: accept it, kill ourselves, or stop searching. For a long time, this conversation stuck with me as I too often pondered the meaning of life, of existence, and questioned what purpose do I serve, do we serve. As I left the theater that day, I wondered if others picked up on that scene and if they had given that scene the same attention I did. Understanding that the film asks questions about why we should memorialize this man and why we should create a legacy rather than being a biopic of who this person is and what his story lends to the underlying existential crisis Jackie faces through much of the story. I revisited this film in a short course for philosophy in which we examined this scene further and its relation to works of philosophers like Albert Camus. As a result, I became more fascinated with the topic of existentialism, a school of thought dedicatedto the rejection of the claim that life has an inherent meaning; a philosophical movement dedicated to understanding existence.

However, existentialism is more than questioning life and existence; it extends to examining the nature of the human condition. This philosophical movementattempts to account for what makes humans different from other forms of existence, from animals. It attempts to distinguish the features between the two. Existentialism can be dated back to Ancient Greece with philosophers like Socrates. Socratesadvocated for the practice of philosophy to be the care of the self, and the focus was placed on the "proper way of acting rather than on an abstract set of theoretical truths." During the Hellenistic period, the theories Socrates introduced flourished andphilosophers became knownas the "kind of doctorof the soul". Furthermore, philosophy in its theoretical approach became widespread as the "pursuit of basic truths about human nature and the universe" (Flynn).

In mid-nineteenth-century Europe, existentialism gained popularity again with the works of Søren Kierkegaard, who is considered a founder of existentialism. Along with Kierkegaard, Friedrich Nietzsche was a famous philosopher thought to be a precursor to the movement.

Kierkegaard's works like Either/Or and Fear and Trembling lent to his popularity as he made arguments like living an ethical life is better than the aesthetic life and emphasized the "teleological suspension of the ethical" (Judaken and Bernasconi 214). Much of Kierkegaard's work was influenced by his Christian faith as he often alluded to biblical stories and made claims that justified actions of Christians like disregarding morals for your relationship with God.

Nietzsche is often associated with his ties to Nazi Germany; his work was additionally used to justify the atrocities committed by the Nazi regime. Much of Nietzsche's work involves undermining the lies people often recite to themselves in order to keep going; he argues that "men must accept that they are part of the material world, regardless of what else might exist".

One of his popular claims is that we must all live as if this is all there is and to not live is a failure to realize human potential (Wyatt and Schnelbach).

The twentieth century brought in a new wave of philosophers primarily composed of French and German authors: French men like Albert Camus and Jean-Paul Sartre and German men like Karl Jaspers and Martin Heidegger. With them, they brought more fame to the movement as Sartre and Camus wrote existentialism-influenced plays and novels like Nausea and The Outsider. Over time as more philosophers with their own ideas came into the limelight, they brought with them critics like Gabriel Marcel, a French Catholic philosopher who was often associated with Sartre's antithesis movement. Furthermore, the distinction between philosophers became clearer as intellectuals like Marcel, Jaspers, and Kierkegaard became associated with "religious or theistic existentialism." In contrast, scholars like Sartre and Camus became associated with their atheism or denial of God. Existentialism as a movement became popular in waves as it spread to different countries in the twentieth century; it traveled from Germany to France to Spain to Italy and eventually to the United States and other countries. As Existentialism entered modern society, it met with immense criticism as commentators claimed that the movement was "a bohemian fad." By the mid-1950s, it was thought to be "visible in all areas of human endeavor yet definable in none." The movement was replaced in the 1970s by French poststructuralism and postmodernism as new philosophers rose to fame (Michelman).

Popular concepts in existentialism includeabsurdity, authenticity, and anxiety regarding aspects of life, among others. Absurdity refers to an idea introduced by Sartre regarding the "unfulfillable desire for complete fulfillment." As humans, we are capable of asking questions regarding the purposeof our lives, but when we can answer such questions, we find that we can not accomplish it. Authenticity can be understood by Heidegger's and Sartre's explanations as they claim we need to be honest with ourselves and face our situations rather than using deceptive approaches. Paul Tillich, a German-American Christian philosopher, insists anxiety regarding life eventsis a result of the "threat of non-being." As humans, we are unnervedby the uncertainty that comes with death and ourselves; we attempt to hide from it, but eventually, we will be unable to do so (Irvine).

From the nineteenth century to the twentieth century, existentialism steadily rose in popularity. By the 1940s, it reached its peak in post-war Europe as people viewed the world differently due to the many of the events that took place during the war. The invention of new technology for warfare, young men arming killing machines,and leaders citing various causes to champion the war effort all resulted in people asking new questions of the future. Existentialism interacted with the war and Nazi Germany in more than one way: during the war, it influenced Nazipolitics and was used to justify the actions of the Nazi soldiers and the regime,and after the war, it was used to remove the moral exhaustion that took over Europe and give life meaning again and to gain the motivation to bear the burdens of the daily life (Lalka). The leading figures of the philosophical movement, Existentialism, were able to influence various aspects of life and society, including religion, politics, and methods of discrimination; changing the perspectives of believers of Abrahamic faiths and non-believers, to its weighted role in political relations and armed conflicts, to altering the way race, gender, and sexuality are viewed in discriminatory lenses.

Existentialist's Religions

Philosophers tend to attempt to understand the meaning of body, existence, and life in terms of religion, faith, and the lack thereof. Many existentialists are associated with their religious beliefs, Soren Kierkegaard was a staunch Christian, Jean-Paul Sartre was an Atheist, and so on. The analysis of existence often stems from questions of faith and belief as religion attempts to justify and give meaning to life. The assignment of duty and worship are meant to sustain people, but what happens when you do not believe? What are non-believers to stake claim in? Existentialist ideology answers such questions for those who believe and those who do not and in the process of answering questions, one finds that new ones arise. As one critic suggests, existentialism can be understood as being more than "being antithetical" towards religion as the movement is often associated more with agnostics and atheists, than theists (Hoffman). With the discussion of religion in any field comes questions of morality, ethics, and duty, Existentialism is no different. In this section, I examine the religious motives of the various philosophers who write upon existential thought and the implications of their belief systems in their works.

Christianity

Although different theologians introduced different ideas about Christianity, these "anxious angels" as they were often referred to as derived their ideas from earlier philosophers like Kierkegaard and other key nineteenth-century figures. Kierkegaard is regarded to have had the most contribution to this intersection of existentialism and Christianity. By examining Kierkegaard's Fear and Trembling, we can see how Johannes de Silento (the pseudonym Kierkegaard wrote under for this book) distinguishes differentways of life: aesthetic, ethical,and religious. The Aesthetic is when one lives life through their own experiences, a life of felt experience. The Ethical is when life transcends beyond the personal interests but rather the interests of the whole, the well-being of all and is based on the idea of "Absolute Mind" as Hegel

calls it. However, it reminds me of a line from Jean-Paul Sartre's Existentialism is a Humanism, "everything happens to every man as if the entirehuman race were staring at him and measuring itself by what he does", I read this as becoming like a role model for society in terms of morals and ethics similar to the ethical lifestyle Kierkegaard depicts (Sartre 26). Sarte tells us to hold ourselves responsible for our actions and to keep in mind the way they influence or affect others. It truly is an underappreciated concept as it could make more people inclined to stay on the side of the so-called morally good; the idea that the actions of one person can enforce a standard for all to meet. The Religious way of life works on the individual level as it relates to the personal relationship between god and the individual, a personal matter.

Johannes (Kierkegaard) introduces religion to the equation in his discussion of the universe, one whose discourse revolves heavily around ethics. According to critics, by factoring in religion and faith, Kierkegaard was able to examine the "wider implications for the whole relationship between faith and philosophy"(Judaken and Bernasconi 213). As Kierkegaard toggles between faith and ethics, he asserts an exception to the morals and ethics that rule those of the Christian faith. His assertion involves a maneuver known as the "teleological suspension of the ethical", this concept allowsthe individual to place himselfabove the universal obligations that those who follow ethicalbehavior do (Judakenand Bernasconi 214).In Fear and Trembling, Kierkegaard cites the story of Abraham and Isaac to provide an example of how Abraham places himself above his ethical and moral obligations as he chooses to sacrifice his son for his faith, going against one of the most basic moral concepts, doing no harm to others.

In re-narrating such a story,Kierkegaard was able to assertthat "choosing oneself", choosing one's faith, is a matter of authenticity and one of importance (Khawaja 17).

Authenticity, as introduced by other existentialists, relates to beingyour true self,and

Kierkegaard puts forth the assertion that the best way to do this is to choose yourself, by choosing your faith. Kierkegaard's motive for his writing is to persuade and remind his peers of Christianity as a practice as he attempts to distance religion from "social conformism", the inauthenticity that comes with doing as your peers do (Guignon). Additionally, through his text, Fear and Trembling, Kierkegaard writes upon human passion and religion's abilityto ignite such passion; he asserts that to become a "self" you must live with "infinite passion" (Guignon).

Authenticity revolvesaround concepts of acknowledging your existence in all its seriousness and then pursuing avenues that allow you to make something of that life, of your existence.

Kierkegaard furthers his argument for religion and passion as he claims that this something you make out of your life must be so consuming and defining that it givesyour life "ultimate content and meaning" (Guignon).

To justify Abraham's suspension of the ethical, Kierkegaard brings the audience's attention to Abraham's anxiety and irrationality. He describes Abraham's acts against his son as lacking human reason or justification as he claims that Abraham's relation to absolute, that is the absolute and private relationship to god is above the universe and the ethical (Judaken and Bernasconi 215). There is no religious law that governs Abraham throughout his actions in the story, only Abraham and Kierkegaard's claim to some unknown communication and trust in a voice that only the father can hear (Judaken and Bernasconi 214). Now, one may ask how does the story of Abraham choosing to sacrifice his son, Isaac, relate to existentialism. In Fear and Trembling, Abraham becomes the "hero" as his actions redeem "humanity from what is otherwise a meaningless cycle of birth and death" (Judaken and Bernasconi 217).

Through the use of this story, Fear and Trembling addresses questions of what is the meaning of life, of existence? Does it require one to be heroic, to ignore morals and ethics? However, Kierkegaard does more than create such obvious and discrete relations between the story of Abraham and existentialism. In all of his work including Fear and Trembling, Kierkegaard works towards the Christian mission, he hopes to rejuvenate belief in his fellow Denmark Christians. His works, though through many voices and under many names, were written to make Christianity more than custom, to bring back "passionate commitment" (Khawaja 18). The use of Abraham's story forces the readers to examine what Kierkegaard is attempting to communicate to them, not that Abraham is some godly figure, or as a story of Abraham's love, but a thorough analysis of faith. It is important to also acknowledge that as the father of existentialism, Kierkegaard's belief in Christianity plays a role in the works of many that follow him as he intertwines Christianity and existentialist thought. I find it interesting how the language of faith, specifically Christianity, in Kierkegaard's works revolves around eternal feelings of happiness or the lack thereof. Furthermore, Kierkegaard's works inspire philosophers like Karl Barth and Paul Tillich as they too use religion to further their arguments and to analyze Kierkegaard's.

The Spectrum of Atheism

Some of the most popular works from the school of thought hail from those who are non-believers of god, atheists, agnostics, and others somewhere on the spectrum, causing one to wonder what notions influenced their work insteadand what moraland ethical considerations are involved in their works. Dubbed "one of the twentieth century's great unbelievers", Albert Camus was famously known for the absence of God in his work. There are arguments for Camus's religious beliefs and the lack thereof, but he himself claims in a notebook of his that "I do not believe in God and I am not an atheist."(Judaken and Bernasconi 257). He situated stories and tales like the Myth of Sisyphus with notions of our own existences, ones we know to be real,

and ones in which all we can do is live. One critic describes this concept beautifully "we must live without appeal … life is without consolation" (Judaken and Bernasconi 256). Camus begins The Myth of Sisyphus and Other Essays with an exploration into absurdity and suicide. He starts the text with a powerfulfirst sentence, "There is but one truly serious philosophical problem, and that is suicide" (Camus 4). This sentence sets up the section titled Absurdity and Suicides; Camus continues his discussion on the topic as he deliberates how futile asking if life is worth living is.

He claims that suicide, however, does not need to be the answer. In this section, he cites an experience he was told undermined a man who committed suicide, and claims that "to be undermined" is where it begins (Camus 5). It is interesting to see how through this text, Camus spreads anti-suicide propaganda, even if it may have not been intentional. He calls out those who are suicidal by claiming that to commit suicide, is to confess that life was too much for you or that you could "not understand it" (Camus 5). He continues to confront potentially suicidal readers as he compares and contrasts the relationship between the absurd and suicide. According to Merriam-Webster Dictionary, the word "Absurd" means "ridiculously unreasonable, unsound, or incongruous" or "having no rational or orderly relationship to human life" ("Absurd."). As Camus elaborates on the term, it is easy to see how fitting the word "absurd" is for what he describes in terms of existential thought. Feelings of absurdity stem from the realization that the lives we live believing that we serve a purpose are just a series of habits resulting in feelings of being purposeless, pointless. Absurd is what Camus labels seeking the meaning of life when there is none; it is absurd to attempt to understand the world. In Absurd Reasoning, Camus addresses the absurd, that life is meaningless, and how regardless of this absurd realization, one must question if life should still be lived, if it truly is that something not worth living.

Camus creates a striking image through Sisyphus, a man condemned to a life of rolling a boulder up a hill just for it to roll back down, and repeating the process. Through this imagery, Camus brings to his readersthe concept of absurdity and notions of "futility and hopeless labor", while emphasizing the desolate nature of Sisyphus's life. Camus also highlights a triumph, "his intense consciousness" as Sisyphus and the rest of us "remain fully conscious that we are condemned to die" (Judaken and Bernasconi 256).Camus frames Sisyphusas a hero as Sisyphus makes no attempts to escape his fate, he continues to roll the rock back up the hill and he describes Sisyphusin heroic terminology to the audienceas he claims that Sisyphus" is superior to his fate. He is stronger than his rock." (Camus 76). Sisyphus's story is a great example of absurdity as he repeats his actions, a force of habit, knowing that is meaningless, and still doing it, still existing and living. Sisyphus is solidified as a hero by Camus as he gains something with his knowledge of the truthof a lackluster reality. ThroughThe Myth of Sisyphusand Other Texts, the audience is asked to understand notions of the absurd and absurdity, but it begs the question of why? Why cause your readers misery and suffering pondering these questions themselves?

Like Camusclaims in the text, you can find meaning in the meaningless existences that we all live, by taking solace in the fact that there is no meaning at all.

Jean-Paul Sartre is another famous non-believing existentialist, his famous text Existentialism is a Humanism links the school of thought and atheism together in a very convincing argument. "Existentialism is nothing else but an attempt to draw the full conclusions from a consistently atheistic position", this is an example of how Sartre claims the two connect (Sartre 53). He also claims that humans are not constructed for some sort of divine intervention or calling from above,but rather to live theirlives as they please. When attempting to understand this text, one needs to understand what the word "Humanism" means itself. According to the

Merriam-Webster Dictionary, Humanism is "a doctrine, attitude, or way of life centered on human interests or values" ("Humanism"). In this text, Sartre upholsters this notion of Humanism revolving around the concept of "man is always outside of himself" and reminding "man that there is no legislator other than himself and that he must, in his abandoned state, make his own choices" (Sartre 52-53). These quotations from Existentialism is a Humanism are important as human choice and being the standard for morality and ethical behaviors are major concepts introduced in this text. It is interesting to see how different two existentialist texts related to moral and ethical behavior can be.

When comparing Kierkegaard's Fear and Trembling to Sartre's Existentialism is a Humanism, the most importantdifferentiation to make is their respective assertions for maintaining certain standards of morals and ethics. Kierkegaard allows for the individual to disregard moral and ethical behavior when it concerns the thing you are most passionate about; whereas, Sartre asks that the individual remembers that other individuals can witness your actions and to conduct yourself as you would want others.

Another thing to note about this text is that this is one of Sartre's most criticized and most-read works. Sartre's denial of God is strongly reflected in his works, and he repeatedly asserts that "[man] is responsible for everything he does" (Sartre29). He was even dubbedby many as "the most famous atheist of the twentieth-century" (Judaken and Bernasconi 261).

Being and Nothingness, another one of his texts, looks at the nature of being. Under the assumption that God does not exist, Sartre examines the meanings of god in life. The best quote to describe this exploration is "the best way to conceive of the fundamental project of human reality is to say that man is the beingwhose project is to be God" (Judakenand Bernasconi 261). Ithink this is a reallyinteresting take on humans and their behavior, as it insinuates that humans

created this concept of God, only to play God themselves. Thus, making God a goal and a source of frustration.

On a side note, it is interesting to consider how critics believethat more of Camus's work is about the absence of god than Sartre, yet Sartre is best known for his atheist ideology. When speaking about Jean-Paul Sartre's relation to other existentialists, it is important to mention Gabriel Marcel. Marcel was best known for his criticism of Sartre's work ranging from notions of the self to death of god and to notions of having no exit after life. Marcel generated his own literature through analyzing and responding to the works of other existentialists, specifically existentialists who were atheists. Much of his work retaliates against the absence of god in the works of others as he offers alternatives that include god's presence.

In my attempts to find reliable statistics about the popularity of various religions during the 1940s, I found that from a quick Google search, "statistics about atheists from 1940s", an article named Why 1940s America wasn't as religious as you think — the rise and fall of American religion, I point towards this article for various reasons, its catchy title for one. More importantly, however, the article affirms the notion that the number of believers was decreasing in the 1940s, specifically, post World War II ("Why 1940s America Wasn't as Religious as You Think"). According to a study into religious experiences during World World II of the American Military by Nicholas Pellegrino, atheists were found to be sparse among the military men. Like the less reliable article cited above suggests, after the war military men who did not believe in a religious denomination significantly increased. The study cites the horrors of the battlefield and the traumatic experiences that come fighting on the battlefield as a primary reason for this change (Pellegrino 11). While these changes can not specifically or directly be attributed to the increased awareness about atheism and agnosticism from existentialist thought, it is interesting to consider how the lack of faith was becoming popular around the same time that existentialism was reaching its height. It is also important to note that later in the same study, Embattled Belief, the author quotes Henry Giles, who confessed in his war journals that he stopped praying during the war as his prayers were never answered. Another soldier is cited for his recountings of instances where god and faith were met with skepticism in the military as peers asked if there were any use for praying, questioning if praying would truly be able to stop another attack (Pellegrino 167-168). Secularization, perhaps, is a limited phenomenon.

Judaism

Jewish philosophers are thought to have joined the movement due to a different set of motivations than many other existentialists, and its effects on their work may not be as obvious as one might think. It is interesting to consider how Jewish Existentialism came into existence when the philosophical movement gained popularity through the works of many Christians and non-believers. In Jewish texts like the Books of Ecclesiastes and Job, one can see existentialist themes present as the books tackle questions of meaning and suffering (Gold). The Book of Ecclesiastes is aboutEcclesiastes, a man who is in searchof the meaning of life. We are asked to understand his motives as he tried various methods to distance himself from the truths, most commonly discussedin Camus's works, like life is meaningless and every life ends in death. The narrative changes as the readers progress through the story: Ecclesiastes turns to God to find meaning in life and advises the audience to do so too. He continues on to ask each individual to live life, believes in a higher purpose, and "to remain humble" as we are all encouraged to live life in the moment (Gold). The Book of Job is a text that takes on slightly darker themes as the story of Job is one in which God and Satan create hardships for Job in order to test his faith. The

story asks the reader to consider what righteousness provides you and if you learn anything from this story, it does not protect you from suffering. Due to a bet God and Satan make, Job is forced to suffer a series of misfortunes and then physicalpain in the form of boils. When Job insiststhat he has not sinned but his peers tell him that he must have, he "berates God" (Gold). God then responds reminding Job of who Job was and who God was and then returning all of Job's wealth and more taken from him back. This text is interesting in how God allows for misfortune to come to an undeserving man and shames the man for complaining about it. Returning to the text through the lens of Existentialism, it is one of great suffering and one that questions whether living was worth the pain and suffering Job experiences.

Martin Buber and his philosophy of dialogue were largely associated with Jewish existentialism. He rejected the label of existentialism and believed deixis, pointing, as the function of philosophy which results in the lack of proper rational acknowledgment. His book, I and Thou examines two modes of interacting with the world. The first is I-It which is where we engage the world as an observer rather than a participant. The second mode is I-You which relates to encounter, the participating in a relationship with an object encountered. Buber's main claim was that the mode of experience is crucial to surviving and his purpose was to help others recognize the modes in which they do so. He claims we need to trust in science but at the same time claims that science is not enough for humans (Zank and Braiterman). Franz Rosenzweig, another German-Jewish theologian, called for a "New Thinking" due to dissatisfaction about the limits of philosophical rationalism. "New Thinking" was a push for more existential principles; this movement hopes to address the existence of the thinker and individual. Buber and Rosenzweig were able to use existentialism to revalorize and explore Judaism as Judaism was collapsing in the wake of liberalism and Enlightenment. The Jewish answer to the question for existentialism, the problem of human existence, was that "without holiness we sink into absurdity. God is the meaning beyond absurdity." (Judaken and Bernasconi 248).

Jewish people sink into a dilemma between a life committed to the sanctity of life and the unending question of its meaning. Many of these questions enter a stage of urgency for the Jewish during the Holocaust and Nazi Germany's rule.

Political and Armed Conflict

The philosophical movement, Existentialism, reached its height around the same time World War Two was taking place. With the genocide of so many, questions of how one would justify the annihilation of so much life arise.Additionally, after discussing Judaism and how its believers were stuck debating the question of the sanctity of life, it begs the question of what justifications those who tarnished that very sanctity of life operated under. In this section, the texts examined are strongly associated with the Holocaust and the Nazi Regime by the general public and various critics.

National Socialism, the political ideology of the Nazi Party, was influenced by Friedrich Nietzsche's sister's effortsto change the narrative. Elizabeth Förster-Nietzsche, Nietzche's sister, took Nietzsche's estate after he succumbed to his "madness" and "insanity"; with the control Elizabeth had over his writings, she was able to compile The Will to Power and somehow conjure conversations she had with her brother to support her own political ideology. With Nietzsche's work, in specific, it was easily misconstrued and misunderstood, Elizabeth was easily able to make Nazi soliders look toward her brother's work to justify their work and their beliefs (Hendricks). Nietzsche's philosophical work was further misinterpreted by Nazi philosopher in order to generate Nazi propaganda; his work was manipulated to the point, one could compare Marxism in the Soviet Union to Nietszchean thoughts in Nazi Germany (Yablon 740).

Nazi apologists chose Nietzsche over other German philosophers with reason: they found many things of use in his work, many things that could be emphasized and push forth their agendas, justifying "world domination and racial hegemony" (Yablon 741-742). Nietzschean scholars were able to generate a story, one in which Nietzsche predicted the Nazi Regime and more than sympthasized with their ideology and even popularizaed the notion that he should have been alive during the Third Reich (Yablon 743). It is important to consider how such works can be understood and interpreted by its audiences. When attempting to understand Martin Heidegger's relationship with Nazi Germany, one must take a different approach from that of Nietzsche: one in which you examine how Heidegger's support of the Nazi Regime affected his work. While Heidegger was not discussed in this text, it is crucial that the difference is highlighted: how one's work is altered to support such an evil regime and how one actively supports the same regime.

Discrimination and Otherness Gender

For much of this essay, I have discussed themes centered around morality and ethics as these are crucial sets of beliefs for a society to prosper and cultivate "good". With a movement so focused on existence and its meaning, it is fascinating to examine how the existence of people who are often considered "other" are understood. Feminism is a social movement that has been on the rise for centuries and Simone de Beauvoir handles the topic in ways many would not think of. Simone de Beauvoir is best known for her work, The Second Sex in which she examines sexism and feminism amongst other topics (Judaken and Bernascon 360-361).

Although she did not consider herself a philosopher as she claims in her autobiography, her ideas lent largely to the concept of feminist existentialism and feminist theory in general (Judaken and Bernascon 362). She calls for the abolishment of the "eternal feminine" and argues for sexual equality, an idea that was not a topic of phenomenological discussion before her. She employed two main arguments to convey the idea: exposing masculine ideology exploits the differences between men and women to create a system of inequality and how argumentsfor sexual equalityerase the differences between men and women to establish the masculine subject as the human example.

She asserts this by debasing Plato's argument that sex is an accidental quality, making men and women equal. However, Plato also believes for women to be treated the same as men they need to train, live, and continue their lives as men do - Beauvoir asserts that Plato fails to acknowledge that this idea does not solve the discrimination towards women in play. Beauvoir's argument for gender equality is that both men and women treat each other as equals and in order to do so they must validate their gender differences; she highlights how equality does not mean "sameness" (Bergoffen and Burke). The Second Sex can be understood as existentialist in that each individual is capable of and shouldhave the freedomto define who they are themselves and claim the responsibility to live upon to those standards and more.

Upon further examination, I hope to be able to explore the responses and changes in perspectives of members of society. Did people of different socio-economic statuses react differently? Were some groups of people more willing to entertain the notions introduced? Were women able to gain more freedom due to the introduction of ideas by those like de Beauvoir?

For further research in the intersection of discrimination and existentialism, I hope to examine how discrimination based on sexual orientation was tackled by existentialists. When many believe that there is no meaningfor existence, how do existentialists provide justification?

Do they provide any at all? Did the stigma around those who did not identify with heteronormative sexual identities change? Were members of this group able to be more expressive and open about their sexualities? Did more people voice support? Were there any implications on how religious groups and organizations viewed people who were part of the LGBTQ+ community? Additionally, I would like to furtherexamine discrimination on the basis of controversiality, what was left unsaid, and how these groups of people were treated prior to such discourse and after.

Conclusion

As a school of thought addressing the meaning of life and existence and examining human nature, existentialism brought many changes to post-war Europe. This research aimed to identify how newly introduced ideas affected society, various aspects of life, as well as religion, political and armed conflict, and discrimination. This philosophical movement changed the perspectives of people of different faiths about their respective belief systems and religion in general. Existentialist philosophers changed the way society viewsrace, gender, and sexuality in terms of discrimination. Additionally, after World War II, existentialism allowed Europeans to ask questions and seek answersdue to the exhaustion in the wake of the devastating war in order tofind the motivation to continue. More significantly though,society changed the way it thought as a result of the introduction and explanations of existential concepts and altered its perception on various topics to some extent.

Existentialism as the name suggestshas much to do with existence and the questions that come along with it. Existential questions and religion go hand in hand as both help you understand how to live life. Philosophers like Kierkegaard and Marcel infused their work with

biblical references and quotes not to establish rhetorical credibility but to instead demonstrate religious faith as they tied religion to existential conceptsof life, death, and morality.

In a similar manner, philosophers like Sartre and Camus emphasized their lack of faith in god as they repeatedly mentioned the lack of or absence of god in the plays, novels, and other works.

Philosophers, whose work is strongly related to concepts like race, gender, and sexuality, use strong language to assert radical claims for ideas like gender equality and feminism. They are often motivated by their own beliefs as they create their work. Much of existential philosophy has to do with the intellectuals writingand spreading their beliefs which then affectssociety as readers are often convinced of and embrace those ideas as we have explored in the paper. It is interesting to examinehow circular the spread of ideas can seem in the languageof philosophy and theory.

From Kierkegaard to Marcel, from Nietzsche to Camus, from Buber to Tillich, various ideas have been introduced throughout the duration of the movement. They have influenced various aspects of society that writers were already influenced by. For example, as a Christian, Kierkegaard integrated many elements from religion into his work; the best instance would be his use of the story of Abraham and Isaac to convey his idea of a teleological suspension of the ethical. In Fear and Trembling, he uses this story to examine how religion and faith interactwith philosophy and justify an exception to the morals and ethics of society as he allows for an individual to place their faith over their moral obligations.

He cites Abraham's choice to sacrifice his son, Isaac, for his faith and relationship with God to show how it is a necessary feature of the Abrahamic faith. Not only does Kierkegaard attempt to justify these actions, but he also turns Abraham into a "hero" as he redeems humanity from a meaningless cycle of birth and death.

When spread to other Christians, this concept allowed them to justify Abraham's actions and

themselves further if they are ever placed in the situation that forces them to make such a sacrifice. Kierkegaard's Christian faith resulted in his writing in relation to Christianity, which helped other Christians "better" understand their religion. Similarly, other existential philosophers used the conceptsand aspects of society they were familiarwith to identifyclaims and argue them.

While we were able to understand some aspects of the changes brought about by existentialism, there is still much to understand and uncover. We do not understand how existentialism influenced society and the common beliefs prior to World War II. One aspect of life this research fails to consider is the culture and the societal expectations members will have for each other, will knowing that many are struggling to bear the burden of living to create more leniency for peers at this time? How did people understand their peers after understanding existentialism? Did it change their opinions on material wealth and happiness? This research brings new questions: if it was not the popularity of some philosophers like Jean-Paul Sartre prior to his existential work, would existentialism gained the same level of popularity. In the same line of research, anotherquestion arises: wouldexistentialism have risento the same level of popularity if it was not for World War II, leaving many to question their lives in its wake.

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Project 42: Reductionism via Necropolitical Artistic Efforts

Alice Huffstetler

Remembering those in our communities who pass on is a large part of human interaction, but with that comes the politicizing of bodies and decisions of who is granted peace and visibility. In this process, identities are summarized into clean-cut boxes.However, identities are never stagnant and various identities inform one another and in looking at intersectional identities, violence can be committed from multiple angles, all trying to render marginalized communities invisible. In this paper, I'll be looking at how the lives of trans individuals are reduced to the violence committed against them, and what is at stake when the reason for violence against trans people is reduced to a single identity, specifically in the setting of memorialization. To accomplish this, I will be analyzing and critiquing Project 42 by Molly Vaughan, a white trans woman, and how this project interacts with trans necropolitics, the white savior complex, the use of affect, a visibility hierarchy, and reductionism via trends of remembrance. Vaughan takes screenshots from Google Earth of locations, each where a trans individual was murdered, then turns them into a textile pattern, and then this pattern is used to make a dress, with forty-two in the collection, including Fred Martinez and Lorena Escalera Xtravaganza.

Project 42, started in 2006, is geared towards memorializing forty-two of the trans lives lost in the United States in the early 2010s. In a TEDx Talk in 2019, Vaughan also shares another meaning of the number, mentioning that it is also the average expected age for trans people at the time of their death, while also recognizing that her life expectancy will probably differ from this, given her more privileged position as a white person. While this recognition is an important step — along with her recognition that each year, "over 90% of those murdered were trans women of color" — this still doesn't detract from the fact that much of Vaughan's work acts as a tool that exploits trans people of color. Furthermore, her discussion of life expectancy is reminiscent of the idea that's been floating around for a while, which states that the life expectancy for trans women is thirty-five years old. Stemming from "A 2015 Inter-American Commission on Human Rights report [that] looked at 594 homicide cases across 18 countries in which the victims were LGBTQ and found that 80 percent of trans women victims were under the age of 35," media outlets circulated into the press that "the life expectancy of trans women in the U.S. is 35 years old," which is a vast misrepresentation and failure of proper statistical analysis.

In this same TEDx talk, Vaughan talks about "a time when our clothes were made by our communities, our families" and then says, "we make garments for the dead." The key point to look at here is whether or not this same work is being done before their deaths and is Vaughan, representative of a larger population of white people, only claiming community after the deaths of trans people of color when it is more convenient and she does not have to engage with their personal perspective? An example of one of the installations is one done for Fred Martinez (Figure 1), a trans Navajo who lived in Colorado and was killed at the age of sixteen.

Furthermore, it is important to note that I wish I could tell you what Martinez was like and what they loved in life, but articles about each of the individuals discussed in this essay are only descriptive of the brutality and harassment committed against them. This specific installation, as described on Vaughan's website, displays "inkjet printed fabrics with gold thread embroidery and vintage lace sewn." A noticeable characteristic of these dresses are how they blend into their background, which I initially thought could signify how trans people are forced into invisibility and aren't allowed to stand as people outside of the context of their death. However, Vaughan

Figure 1: Textile piece created for the intention of memorialized Fred Martinez

identifies this camouflage as a "discussion of outing and passing." I think this approach is too surface-level and borders on superficial, especially since she's mostly focusing on the violent deaths of trans people of color. Vaughan also states that these pieces are meant to contrast with the piece memorializing Lorena Escalera Xtravaganza, which defies Vaughan's artistic trend in this project of utilizing camouflage.

Xtravaganza (Figure 2) was created using "inkjet printed textiles, silkscreened fabric, muslin, antique lace, antique dress form, cotton piping, wallpaper, and bronze and quartz crystal necklace." Vaughan identifies that this piece is supposed to discuss constructs of gender identity, as the dress is constructed around a traditional Victorian bust, a strict expectation for women's fashion and women's bodies during the Victorian period. Vaughan's position in creating this project is significant in analyzing this visibility hierarchy between white trans people and trans people of color.

A significant design detail in Xtravaganza's dress is a stenciled, fragmented poem by Emily Dickinson. Vaughan's use of the words of a cis white woman to express and inform the death of a trans womanof color is quite effective in establishing her position of power in this storytelling.

Figure 2: The elaborate Victorian-style piece done for Lorena Escalera Xtravaganza

This idea harks back to Thomas Page McBee's discussion of the normalized trans narrative in "Trans, but Not Like You Think," in which cis people insist on framing trans narratives in their own terms so that it is comfortable and easier to understand for them. This is also accomplished by Vaughan in the aforementioned TEDx Talk, in which three "guardians", all white women, say the names of three trans women of color who were murdered in 2018 (London Moore, Nikki Enriquez, and Ciara Minaj Carter Frazier). Throughout this talk, these "guardians" stand behind Vaughan as she talks about her project, and toward the end, during a powerful performance by Randy Ford, a trans woman of color, they come back to "protect Tyra's [Trent] spirit as she enters into this space." During this performance, Ford/Trent is rendered silent, only communicating through dance and one agonized exclamation of Tyra Trent's name at the end.

This performance is symbolic of Vaughan's puppeteering of narratives of trans people of color, where she silences the voices of both the deceased and the living members in the trans community and speaks for them, making their narratives her own. In Sarah Lamble's "Retelling Racialized Violence, Remaking White Innocence: The Politics of Interlocking Oppressions in Transgender Day of Remembrance," Lamble discusses the dangers of "a singular identity plane of victimhood" (31) and how white people can perform innocence to ignore their own complacency in systemic violence. This silencing of the dead allows the complacency of those in positions of power to go unchallenged. Lamble states: "In taking the voice of the other as our own, we colonize the bodies of the dead. These narratives speak not to the honoring of life, but to the fetishization of death" (40). In a promotional video posted by the Seattle Art Museum on YouTube, Vaughan highlights the importance for her pieces to be "aesthetically captivating" in order to pull people into having conversations, which works to reduce the deaths of these individuals as a way to justify the means. Vaughan uses their violent death in order to contribute to her own occupational gain, justifying their deaths as a way to have conversations about this violence. While this violence is critical to deconstruct and prevent, Vaugan's project falls short by utilizing traumatic deaths without substantial consideration.

This reduction echoes points made by C. Riley Snorton and Jin Haritaworn in their piece on trans necropolitics: "The extraction of value from trans of color lives through biopolitical and necropolitics technologies not only serves the sovereign, but also indexes much more subtle and complex shifts in power" (71). Vaughan is able to assert her power by placing herself at the forefront of this storytelling, contextualizing these deaths on behalf of the deceased individuals, instead of allowing their personal stories and lives to speak for themselves. She also accomplishes this by avoiding uplifting the voices of living trans people, such as Randy Ford, an iconic powerhouse of artisticperformance. Vaughan's dominance over the storiesof trans people of color is dangerous because "the circulation of trans people of color in their afterlife accrues value to a newlyprofessionalizing and institutionalizing class of expertswhose lives couldnot be further removed from those they are professing to help… it is in their death that poor and sex working trans people of color are invited back in; it is in death that they suddenly come to matter" (Snorton and Haritaworn, 74). These slight acts of domination position "White activists…as saviors of victims of color" (Lamble, 35). These power shifts allow for the normalized, traumatic trans narrative to remain in control of trans storytelling. This narrative, further critiqued by Jacob Tobia in "A Quick Manifesto," is both an "oversimplification of the trans community" and "a tool…that continues to pressuretrans people into fitting into one of two binary genders" (14). The trauma-focused narrative negates the existence of intersectional identities, and calls back to this "singular identity plane of victimhood" (Lamble, 31) where discussion of how systems of power perpetuate violence is nipped in the bud and isn't picked back up until another person is assaulted.

This single plane of victimhood calls for single planes of action, which are too narrow and exclusionary. Kimberlé Crenshaw's "Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color" explores how paths to justice against violence are often separated by identity. Crenshaw discusses how "feminist efforts to politicize experiences of women and antiracist efforts to politicize experiences of people of color have frequently proceeded as though…[they] occur on mutually exclusive terrains" (1242). She elaborates on this by talking about her visits to shelters for survivors of domestic abuse and how women of color experience domestic abuse in an amplified way, due to gender, class, and racial discrimination. The issue arises when "intervention strategies based solely on the experiences of women who do not share the same class or race backgrounds" are being used to help women of color, because they will always fall short of their needs. Looking at violence with these intervention plans in mind helps to contextualize the effects of necropolitics on trans narratives, because like necropolitics, they dictate a singular idea and fate of an individual or group. This idea is important when looking at trans narratives because the life and death of trans folx, especially trans people of color, is decided before they're born. The "singular identity plane of victimhood" allows for one context of remembrance, where grief and peace are skipped over and that person is contextualized by the way they were killed. This is not to say that violence experienced by trans persons of color disproportionately is not important to recognize and fight against, it is simply that the violence is what is being focused on, instead of the actual person lost. Once the traumatic normalized trans narrative has dug its feet into the sand, power systems allow this narrative to stick around. This allows for complacency when grieving the lives of trans people.

Vaughan utilizes emotional power and shock to draw people into these stories, simultaneously sparking important conversation while still objectifying the lost lives of these trans individuals by mysticizing their deaths. The use of affect is integral to Vaugan's message,

where she utilizes dance performance and visual illusions. In Vaughan's TEDx talk from 2019, she identifies these forty-two lives as "spirits" and how when people come into the art gallery, they must open themselves up to them.By this description, affect is beingused here to create the feeling of unresolved tension, specifically from grievances of the deceased. In that same TEDx talk, the role of the guardians and the spirit of Tyra Trent create an aura of an other worldly or paranormal encounter, emphasized by the stationary position of the guardians and the expressive body and face of Ford. This use of the paranormal harks back to Evan B. Towle and Lynn M. Morgan's discussion of the mysticized and limiting "third gender" in "Romancing the Transgender Native: Rethinking the Use of the "Third Gender" Concept." This concept "lumps all nonnormative gender variations into one category, limiting our understandings of the range and diversity of gender ideologies and practices" (672). Vaughan's use of affect allows her to further separate herself from these narratives. She places herself as a living person, much different from the deceased, and underlines her own poweras a white savior by claiming that she is allowing these souls to come into our world.

In the video by Seattle Art Museum, Vaughan states that because so many of those murdered are trans women of color, she wanted to incorporate more performers that are trans women of color, which is a critical step in uplifting voices of influential members of the community. Vaughan also discusses how she did not want the performances to be on record for the public so that people could only experience them in real time. If people were not present, the performance would still go on, symbolizing, in Vaughan's eyes, how lives "come and go." This symbolizes how a majority of lives lost are not recorded and adds to the conversation of who is made to be invisible and what lives are considered valuable or worthy of grieving.

Looking at different trends of memorialization are crucial to trans studies because necropolitical tactics decide the fate of multiple areasof a trans person's life.These methods can simultaneously render a trans person invisible and be the only thing that brings their experience into discussion, as often "the very existence of transgender people is verified by their death" (Lamble, 34). The violence and manner of a person's death cannot be the only thing that contextualizes their perspective and experience, which is why it is important to learn about and speak about a person's life with the goodness they added to this world and the joy they experienced, underlining how the violence committed against them will not be tolerated and demanding that this violence not be forgotten.

These trends of memorialization draw back the curtain and reveal who is deciding who is allowed livelihood and peace. In Dan Irving's "Normalized Transgressions: Legitimizing the Transsexual Body as Productive," Irving discusses economic productivity and Snorton's idea of "the good transsexual" as society's criteria of whose identityis earned validityand respect. Irvingstates, "to move toward achieving social recognition, the transsexual body must constitute a productive working body, that is, it must be capable of participating in capitalist production processes" (17). Vaughan is able to further assert her power over these narratives because she has steady income with a stable job and her work has been recognized in many different venues. While Vaughan profits from this work, the very people these narratives belong to would have never have had the opportunity to have their voices heard. By Vaughan commercializing their narratives, she perpetuates the cycle of silencing and ensures that these voices will never be heard.

Therefore, analyzing necropolitics through a lens of intersecting identities is critical to fully contextualize violenceand how it is perpetuated through visibility politics,the normalized trauma-packed trans narrative, white innocence, and how affect impacts our reception of these remembrance narratives. By using this lens, we can emphasize the value of these lost lives and show how they impact various social justice movements. This can be done through listening closely to individual experiences of trans people, told by the people themselves. By informing our activism with an entirecollection of perspectives, our movement for change can better serve these communities.

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Book of Deer

Madeline Nielsen

Abstract:

In this paper I explore the Book of Deer, the earliest Scottish manuscript. An early Christian specimen, it bears notable evidence of Pagan (Pictish) influence, which interestingly reveals the religious transition in Scotland at the time. I examine its intriguing, bizarre illustrations and stranger marginalia to try to understand and interpret this book, discovering direct quotations from earlier Pictish stone-carving in its design which prove my hypothesis that the book reveals a conception of Christianity inextricably influenced by local Pagan and folk traditions. I examine this book's important physicality, its status as an almost magical protective talisman, purpose as a touchable devotional object for an intimate religious experience, and the power it draws as a receptacle for holy text. Overall, this is a unique book which reveals the context and concerns of its day.

Keywords: Pictish, Scottish, Manuscript, Rare Book, Cambridge, Celtic, Early Christian, Devotional, Illumination, Medieval, Art History, Marginalia, Angel, Evangelist, Christ, Talisman

Sacred Touch: Divine Power and Pagan Pictish Influence in the Earliest Scottish Manuscript

The Book of Deer[1], the first surviving manuscript produced in Scotland, is challenging to study because of its early 9th to 10th century date. It is not situated within a vast manuscript tradition. As such, though one can examine the Irish Christian pictorial tradition, I have found that this is not the only helpful source. Many of the artistic and thematic decisions of the Book of Deer are idiosyncratic, and arguably have their roots in the symbols of the Picts. Taking from the Picts an emphasis on physicality that goes beyond specific visual motifs, Deer comments on the relationship between the human and divine with a combination of tangible immediacy and bizarre spirit-like figures.

Binding and an example of the text, Cambridge Digital Library
https://cudl.lib.cam.ac.uk/view/MS-II-00006-00032/1

Pocket Gospel

The Book of Deer is unique for its size. While it is quite common to see large Medieval manuscripts intended for storage or display, this volume is small and easy to handle. It contains only text from the four Gospels: employing sections from Matthew, Mark, and Luke, the only complete Gospel is John. Sometimes called a 'pocket Gospel', this kind of book is hung around the neck as a satchel, almost as if it were the central pendant of a powerful necklace. This association seems to have been no accident.
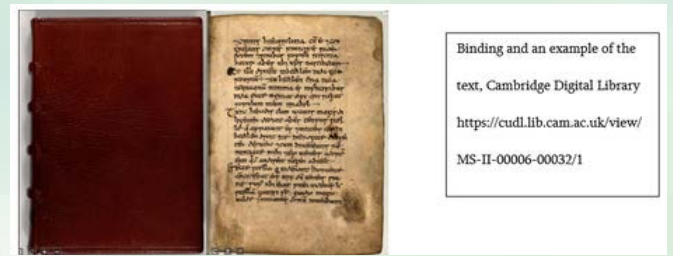
Physicality

The Book of Deer is decidedly physical—it is, obviously, a physical object, but it also of a class intended to be held, touched, transported, even worn. Perhaps unsurprisingly, the Picts appear to have had quite the relationship with physicality themselves. Stevens attributes a complex role to pre-Christian body ornamentation. Sometimes intended to express social or political narratives, "this form of decoration has been seen as a potent factor in expressing…human relations with the supernatural,".[1] Known body-decorators, the Picts valued symbols and images highly, decorating their stone slabs with them. I would argue that Deer is a part of this tradition, taking these ideas of physicality, symbol, and the supernatural into a specifically Christian context.

There is little information on the Picts. They were a warrior nation in what is now Scotland, and even the word 'Pictish' comes from a language and culture foreign to them—it is Latin for 'painted', referring to their body ornamentation. They did not have a writing system of their own, likely, as other Celtic societies, preferring memory—the introduction of Latin with Christianity brought the first known writing system to the area.[1] Aside from treasure hoards, the only remains of the Picts are lofty symbol stones.[2] Several are discovered every year.

Pictish Influence

Surviving Pictish symbol stones reveal direct influences on Deer's imagery and illustration. The Shandwick Cross, still used as a landmark for ships, is an impressive example of one such symbol-stone. Featuring a cross and angels with x-shaped wings, it also draws heavily from pre-Christian animal designs. The inclusion of snakes is interesting, given their negative Christian connotation. Sutherland, in her guide to Pictish stone symbols, decodes snakes as holding connotations of "wisdom and healing, renewal and immortality" in Celtic pre-Christian contexts. Perhaps it is the same on this Cross—the snakes might allude to the resurrection. A more direct quote comes from the Hilton of Cadboll, another large cross slab. The top includes the pre-Christian 'v-rod with crescent' design along with the cross, which Sutherland decodes as "Probably associated with moon. Royalty, fertility, regeneration and the tides".[1] The insertion of Pagan, nature-based symbols beside Christian ones perhaps alludes to the continued importance of those ideas at the time.

By using these symbols, the maker draws a possible connection between the Christian idea of 'regeneration'—and thus the cross--with the natural phenomenon of oceanic tides. The Christian idea of rebirth through resurrection is tied to the Pagan idea of the cycles of nature. Most strikingly, the original base of the cross includes a tight geometric pattern that appears exactly as a common motif in Deer. Overall, this seems to point to Deer taking most of its pictorial inspiration from the fusion of Pagan and Christian in Pictish art and symbolism.

Shandwick Cross

"Clach a' Charridh (Shandwick cross) slab) – Flickr – S. Rae.jpg"

Wikimedia Commons

(My crop) image from the Book of Deer (Cambridge Digital Library) alongside original Shandwick base

Photo: Seaboard Memorial Hall, Cadboll Stone Base

The Picts were a warrior nation, and the book was produced during the mysterious time of transition from a Pagan Pictish society to a Christian Scottish kingdom. Possibly a time of peaceful assimilation, some scholars argue that it was full of anxiety and turmoil. Perhaps unsurprisingly, then, Deer is full of talisman, warding, and warrior imagery. And that starts with the very texts chosen. The pre-Christian context is important, but only half the picture—I ought not to ignore the explicitly Christian elements, and one of these is the fact that the only complete Gospel in the short book is John.

Christian Influence

John, considered to have the most mystical or even magical properties of the Gospels, begins: In principio erat Verbum, et Verbum erat apud Deum, et Deus erat Verbum, "In the beginning was the Word, and the Word was with God, and God was the Word".[1] In this phrase, John articulates that the Word, often called by its Greek name Logos, is itself spiritually powerful and eternal. Marner states of the Book of Deer that: "The book itself is entirely concerned with the power of the Word of God to conquer evil and cure the sick".[2] Deer is not only concerned with Logos in a theoretical way—it in fact presents it as a practical, immediate spiritual weapon. Discussing recurring motifs in the book's illustrations, Marner asserts that: "Satchels too are represented: worn like armour around the neck, they are an allusion to the power of the Word in a hostile world".[3] In this view, the book, especially its size and function as a necklace, seems to liken itself to a talisman—a protective tool, protective by supernatural traits imbued in its very physicality. In this case, the Word of God.

This gets back to a mysterious figure in one of Deer's full-page illustrations. Seated—possibly enthroned—with an odd head-dress, and holding a sword. Fee, referencing the cultural mixing I talked about earlier, makes an interesting point: "it is important to add that Celtic and Germanic heroic literary traditions gave birth to an Anglo-Saxon understanding of the nature of Christ as warrior that was equally idiosyncratic".[1] "Idiosyncratic", for Fee, means one must look outside the typical tradition to describe it. The figure's identity can not be certain, but the seated position as the main focus of the page is reminiscent of an enthroned Christ illustration in the Book of Kells, a book the illustrator would have likely had some kind of access to or knowledge of (through connection with Columban establishments[2]). Marner argues that the figure is certainly Christ, and is not put off by the sword—they argue that it is protective, and connected to the idea of Logos.[3] They also add: "In devotional manuscripts of the 15th century the face of Christ can be virtually obliterated through the repeated kisses of a reader".[4] While the Book of Deer has occasional irregularities in the parchment, these are small and the manuscript appears un-damaged. This makes the very specific, apparently intentional obliteration directly over the seated figure's face intriguing. An obvious possibility is an intentional act of vandalism. While technically possible, especially given a historical context of possible tensions, I have not seen this discussed anywhere, and am also not convinced by the fact that no other defacement occurs. There are other seated, prominent, full-page figures, who are all in excellent condition. In fact, this book, especially given that it may have been frequently handled, seems to have been treated with the utmost care.

I would, thus, subscribe to the defacement being an intentional but loving act, especially given the nature of this book as an apparently more intimate manuscript meant to be touched and interacted with. It was meant to be worn and seems to have been intended to provide comfort, feelings of protection, and feelings of closeness and communion with Christ. Its cultural context valued physicality, and physicality specifically through symbols and images. It seems most likely that this illustration could be of Christ conceived as a spiritual warrior, and that it is included to enhance intimacy.

Left: Book of Deer (Cambridge Digital Library); right: Christ Enthroned from the Book of Kells

This gets into perhaps the most specific question of all—of the intention and use of the text itself in the Book of Deer in its Christian context, and how the illustrations might shed light on that. While the book does have several fascinating formal illustrations, I would be remiss to ignore the rest: its marginalia. The book is, for the most part, meticulously clean and un-crowded in its placement of text and illustration, save for an odd collection of marginalia scattered throughout, on some pages. The often animal-influenced yet abstract creatures are bizarre, yet feel intentional, and not like an act of vandalism or boredom. It is rarely commented upon closely, but Pulliam, in an article about Deer's marginalia, argues that the marginalia are intended to highlight and enhance the intended meaning of the chosen Gospel passages. She describes the artist as "marshaling a small army of creatures to serve as an emotive chorus, staring and gesticulating towards specific verses, phrases and words".[1] She argues that the highlighted phrases are about death and resurrection, as well as union—that they are overall intended to provide a sense of comfort. For instance, on an otherwise clean page of text, a bird and four-legged animal parade animatedly underneath it. She quotes the passage they mark:

'Whoever eats my flesh and drinks my blood has eternal life, and I will raise him   up
on the last day. For my flesh is true food, and my blood is true drink. Whoever   eats
my flesh and drinks my blood abides in me, and I in him'

This passage is Eucharistic—describing a possibility of human union with the divine through Christ—but also, she argues, highlights the Christian idea of resurrection. This focus on personal relationship with, and power through, Christ would be in keeping with my earlier interpretations.

She makes another interesting claim about a different, more abstract piece of marginalia, of a curling shape featuring a dragon-like head on either end. She quotes the biblical text they sit beneath:

'As the Father has loved me, so I have loved you. Abide in my love. If you keep my   precepts, you shall abide in my love, just as I also have kept my Father's precepts and I abide in his love'.[1]

She interprets the marginalia: "They [the heads] seem to curl within one another, extending the comforting message of abiding within Christ and thence within God's love from word to image".[2] The marginalia seem to visually indicate the idea of union between human and divine that so much of this manuscript apparently intends to foster through its use. Interestingly, if we recall Sutherland's argument that snakes, in a Pictish context, symbolize ideas of renewal and healing, this animal might be pointing even more explicitly to ideas of resurrection.
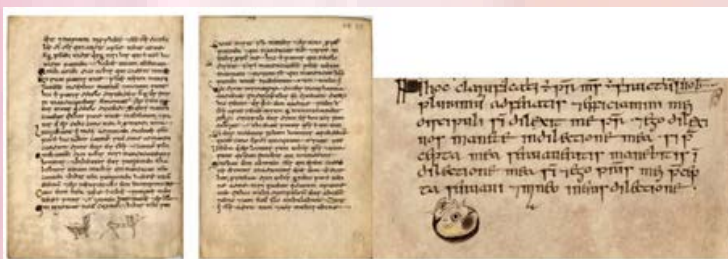
Marginalia examples from the Book of Deer (crop mine) (Cambridge Digital Library)

Comparanda

As I showed earlier in the paper, Deer uses exact quotations of Pictish designs in its illustrations. Most of Deer's illustrations feature figures, but these figures are often ambiguous. Unlike similar Insular manuscripts of the era, the figures often lack traits and indications that clearly define their identity. Deer's figures can be classed into two categories—humanoid, and ambiguous. The humanoid figures often have facial hair, full expressions, arms and legs, robes, and some accessory, such as a sword or satchel-psalter. The ambiguous figures are more strange and lack immediate identifiers, appearing more eerie than their humanoid counterparts. Marner identifies these more ambiguous figures as angels, citing the 'x-shape' that some of Deer's figures have. He argues that this shape denotes wings, and that it has its roots in Pictish stone-carving, which it does. [1] A slab at Kirriemuir shoes a typical square of two evangelist and two angel figures—Pictish stone-carving in general is a very minimalist art form, given the nature of the materials, and it seems that angels always have very clear x-shaped wings to identify them. While some of Deer's ambiguous figures have a version of the x-shape, this does not account for the most strange versions in its pages. The image prefacing John showcases a humanoid figure with robes and a satchel—he is surrounded with six figures, which lack the x-shape, lack clear humanoid identifiers, lack clear clothing or nudity, four limbs, or any kind of identifier. Though Marner would argue they are angels, they look as much animal, spirit, or ghost as angel. How to account for this?

Relief slab from Kirriemuir (Scotland)

This illumination is very mysterious, and my thoughts on it consist of speculation —I have not been able to find any exact comparanda that illuminates the artist's decision here. However, given the Pictish influence (the quotation from the Hilton of Cadboll actually shows up multiple times in the illustration), I wonder if the answer to this strange picture, which does not match up with angel illustrations in other Christian manuscripts such as the Garland of Howth or the Book of Kells, lies in a cultural fusion of more pre-Christian elements from before the Scottish conversion.

Left: Book of Deer (Cambridge Digital Library); right: The Garland of Howth (8th-10th c), Ireland

In the video by Seattle Art Muse[um], [she] states that because so man[y] murdered are trans women o[f color, she] wanted to incorporate more per[sons who] are trans women of color, which [is a] step in uplifting voices of [these] members of the community. V[aughan] discusses how she did not [want] performances to be on record f[or people,] so that people could only expe[rience it] in real time. If people were not [there, the] performance would still go on, [illustrating] in Vaughan's eyes, how lives "c[ount."] This symbolizes how a majority [of lives] are not recorded and ad[ded to the] conversation of who is made to [matter] and what lives are considered [to be] worthy of grieving.

Looking at different [methods of] memorialization are crucial to [study] because necropolitical tactics [dictate the] fate of multiple areas of a tra[nsgender] life. These methods can si[mply] render a trans person invisible, [the] only thing that brings their exp[erience to] discussion, as often "the very [life of] transgender people is verifi[ed at] death" (Lamble, 34). The v[ery] manner of a person's death ca[n be the] only thing that contextua[lizes their] perspective and experience, wh[ich] is important to learn about and [honor] a person's life with the goodness [they gave] to this world and the joy they [lived,] underlining how the violence [enacted] against them will not be to[lerated,] demanding that this violen[ce is not] forgotten.

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Left: Book of Deer (Cambridge Digital Library); right: The Garland of Howth (8th-10th c), Ireland

An examination of Scottish folklore shows that the non-Christian material features its own spirituality, with plenty of references to the supernatural that likely have their basis in Pagan religious thought. The folklore of Celtic culture likely influenced its communities of Christians, particularly early ones, so it makes sense to at least briefly examine it when trying to understand early Christian Insular thought at a time of conversion. Celtic folklore is often mystical, [1] with an emphasis on supernatural entities and liminal spaces.[2] The definition of 'liminal' is "occupying a position at, or on both sides of, a boundary or threshold."[3] In non-Christian Scottish culture, this property occurs in stories about powerful natural elements like water serving as a crossing-point from the human to the magical world, or in Pagan festivals such as Samhain celebrating the thinning of this liminal boundary and its volatile possibilities. I stated at the beginning of this paper that a mixing of many different cultures defines the region. Harris, quoting field research, describes just such a mixing in the mind of a local man:

Campbell's informant divided this group of fallen-to-earth angels: "The fallen angels were driven out of Paradise in three divisions. One became the Fairies on the land, one the blue men in the sea, and one the nimble men (fir chlis), i.e. the northern streamers [Northern lights?] or merry dancers in the sky" (107).

The 'Fairies', 'blue men', and 'nimble men' are all classic inhabitants of Scottish regional folklore, and this local's seamless blending of them with the Christian idea of fallen angels further demonstrates just how much Christianity and folklore and mythology might have influenced each other, even in earlier times.[1] Especially given this example, it seems reasonable that, at this time, Christian thought might have been influenced by a folk culture that conceived of moments of connection between the human and supernatural (or divine) worlds. I speculate that this cultural influence of folklore featuring figures that are not human or God, but "other", with mysterious connections to a supernatural, mystical Otherworld, might explain the strangeness of the Deer figures, which the artist does not portray as human, but which he also does not clearly identify in a Christian angel style. It seems like the oddity of some of Deer's illustrations stem from the fact that it was created during a time of conversion and cultural transition, and that its illustrations represent a people trying to reconcile various traditions in order to understand and make tangible intangible ideas spirituality, faith, communion, and afterlife.

[1] For further reading on Scottish folklore, see: Donoho, and Goodare.

Conclusion

Deer includes two types of figures—humanoid and "other". The strange pairs of figures—spirit-like creatures alongside human satchel-wearers—might not be strange at all. Deer's creator seems particularly concerned with trinity and communion, after all. The book emphasizes, via details like the seated figure for devotional kisses, the tangible humanness of Christ. Through this tangibility, a book one can hold comfortably in one's hands, Deer offers the possibility of union and intimate connection with Christ. Christ is made accessible, the unknowable understandable. However, the divine is not made too human—Deer's creator retains some of the mystery. The details implying a very human intimacy exist directly beside these divine, spirit-like, non-human, non-tangible figures—quite the dichotomy. Might Deer also be commenting on the nature of divinity? Deer is very small-scale and appears closely focused, and I would argue that its focus is on the relationship between the human and divine. It holds, in its illustrations, a reminder of a kind of spiritual Otherworld its audience would have been familiar with, yet also pairs down its focus to a very New Testament, Christ-centered view of Christian practice that, with its focus on Christ's resurrection and union with him, arguably sit at the very essential core of Christianity. Its many idiosyncrasies point to the many influences of its world. Paganism, folkloric ideas about nature and the thresholds between the human and supernatural, Pictish ideas about symbols and physicality, as well as explicitly Christian ideas of healing and rebirth through Christ, all combine and reinvent themselves in its text and illustrations.

It can give an idea of how its creators, and likely their communities, conceived of Christianity and their own spiritualities. The Book of Deer is not removed or theoretical. It is immediate and experiential, physical and symbolic, providing an experience of intimacy with Christ and a feeling of protection against evil for its owner.

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