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EDITORS' INTRODUCTION

Welcome to the 25th volume of the *UMBC Review:* Journal of Undergraduate Research!

For a quarter of a century now, **The UMBC Review** has offered undergraduate students the invaluable opportunity to publish their original research in a peer-reviewed journal. Each of our authors has demonstrated an awesome commitment to research and scholarship while simultaneously juggling the demands of student life in our fast paced, digitally driven world. It is with great pleasure that we, the editors, present to you the following ten exemplary articles which we believe showcase the diversity of scholarship at UMBC.

As an interdisciplinary journal, the **UMBC Review** publishes a collection of outstanding works of authors from any and all disciplines. In this volume, we are proud to feature articles from the fields of music, English, critical disability studies, and ethnography, among others. We begin with **Khoa Tran's** analysis of **Les pêscheurs de perles** and the influences of orientalism and exoticism. Next, **Julia Palmer** teaches us how British colonization has impacted the diet and health of Aboriginal Australians. **Yamini Ravi** and **Ellison Ober** study the relationship between genetics and the decline of immune function with age, and **Zinedine Partipilo Cornielles** looks for a relationship between high school financial literacy mandates a student loan behavior at the state level. Then, **Darcie Adams** coins a new term, "Bitch Syndrome" to describe late-diagnosed Autistic women's experiences with masking the patriarchy.

In the second half of this volume, **Polina Kassir** considers how Zebrafish embryos recover from a lack of oxygen while **Chloe Evered** argues for an active role for linguists in the fight against deepfakes, and **Riya Patel** tackles the relationship between immigrants' culture of origin and their views on the political participation of women. Finally, **Clair Volkening** digs deep into the UMBC writing center and how **English 321** prepares tutors to assist students, and **Layla Ahmed** deploys ethnographic methods to understand how UMBC students think about quantum physics. These authors offer new and insightful research, advancing their respective fields and contributing to our understanding of the changing world around us.

The **UMBC Review** is crafted by undergraduate students, with support and guidance from experienced mentors. All articles are held to the same standard as other established research journals, and each paper underwent rigorous peer review from off-campus professionals and multiple rounds of revisions based on feedback from the editors. Being published in the **UMBC Review** is an honor only a few UMBC students will receive, and we are pleased to be sharing their work with you. We invite you to join us in celebrating the curiosity and creativity embedded in each of these papers!

MEET OUR WONDERFUL AUTHORS!

Khoa Tran takes a nuanced journey into societal critique through the unique lens of opera, exploring the subliminal themes of French exoticism, gender roles, and alternative sexuality in his analysis of George Bizet's "Les Pêcheurs de Perles" (The Pearl Fishers)

Julia Palmer investigates British colonization's impact on the diet and health of Australian Aboriginals, comparing modern and historical sources and incorporating information and experiences from an Aboriginal-led diet tour she embarked on at the end of July 2023.

Yamini Ravi and **Ellison Ober** introduce us to the concept of immunosenescence, the deterioration of immune response as a result of aging, and argue that there is a genetic basis to this phenomenon by delving into how Actin 57B, one of the many genes that influences fruit fly immune response, affects the survivability of aging flies in their fight against E. Coli bacteria.

Zinedine Partipilo 'ZP' Cornielles examines the impact of high school financial education mandates on FAFSA applications, showing how enhanced financial literacy could be a key to navigating the growing student loan crisis.

Darcie Adams proposes a new term "bitch syndrome," intended to encapsulate the experiences autistic women face at the intersection of disability and the patriarchy and the double stigmatization of failing to be feminine enough while also failing to adhere to allistic social standards.

Polina Kassir analyzes how genes like HIF-1α and NDRGs are linked to responses to hypoxia, exploring the role played by NDRG1a in the embryonic survival of zebrafish after undergoing an absence of oxygen.

Chloe Evered builds off of research into audio deepfakes she completed as a summer REU student on an interdisciplinary team of linguists and data scientists, discussing areas where linguistics can help address the growing societal challenges this technology presents.

Riya Patel assesses the impact of homeland gender attitudes on immigrant attitudes toward women in US politics, finding that while homeland gender attitudes have an impact, other demographic variables wield greater influence on these perceptions.

Clair Volkening offers insights into writing and writing tutoring in higher education—how writing tutors can help students find a sense of purpose in their writing and trouble oppressive pedagogical structures within the university.

Layla Ahmed applies anthropological theories and methodology to the UMBC physics department, specifically focusing on students and professors either specializing in quantum physics or taking a related course, in order to get a better understanding of their experience.

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While the focus of the UMBC Review is our undergraduate authors, it would not be possible to publish the journal without the support of numerous other individuals, each of whom is irreplaceable. We extend our sincerest thanks to the following people, without whom Volume 25 of the UMBC Review would not exist.

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CORRECTION:

In the "Acknowledgements" section of volume 24 of the *UMBC Review*, Dr. Anthony Cooling was mistakenly listed as "Mr. Anthony Cooling." Dr. Cooling holds a Ph.D. and did when volume 24 was printed. Accordingly, he should have been listed as "Dr. Anthony Cooling."


01

Fishing for Social Inequities: An Exploration of the Sexual and Oriental in *Les pêcheurs de perles*

Khoa Tran
Dr. Lindsay Johnson

DEPARTMENT OF MUSIC

BIOGRAPHY

Khoa Tran is a vocal performance major at the University of Maryland, Baltimore County (UMBC) studying under Sammy Huh and Leah Heater. He is part of the Honors College and the graduating class of 2024. His work revolves around inclusive art, specifically queer and Asian-American proShouljects. He would like to thank his mentor Lindsay Johnson and URA for making this project possible.

RESEARCH JOURNEY

In order to combat the barriers in art music, many things need to be done both within the field and within society. The art music that is consumed and popularized is within the Western practice and even then the Western art music that is performed sticks within the canon. The barrier of entry to music is high and thus prevents new works, diversity, and representation within the sector. Small steps must be taken before a full change can be made and that is why I chose to explore *Les pêcheurs de perles*. The opera has queer elements from 19th-century France, when homosexuality was not socially accepted. I hope that the exploration of alternative sexuality and exoticism in *Les pêcheurs de perles* offers a new lens through which to understand and produce the opera. Just as new musical works are presented to comment upon present society, older works can be produced in a manner that includes new hopes and ideals.

ABSTRACT

"Fishing for Social Inequities: An Exploration of the Sexual and Oriental in *Les pêcheurs de perles*" explores Georges Bizet's opera, *Les pêcheurs de perles*, in order to highlight works outside of the canon and focus on social progress through an art form that can oftentimes feel conservative. Deceivingly like the typical 19th-century French opera, this opera subverts conservative views of alternative sexuality and separate spheres through a reflection of France within an exoticised narrative. Bizet satirized France's treatment of women and colonial practices through methods of dramatization and characterization commonly part of 19th-century exoticist operas, which is seen through Leila's symbolic and voyeuristic depiction. Exoticism in opera is typically coupled with alternative sexuality which is present in *Les pêcheurs de perles* with the two main male characters, Nadir and Zurga, in their intimate duet, "Au fond du temple saint," as they display characteristics of Foerster's "heterosexual trouble" and Sedgwick's "homosocial desire." These explorations within the opera attempted to open a dialogue about feminism and alternative sexuality which was shut down through Parisian music periodicals. Despite the opera's failed reception, it routinely pops up in the program for larger opera houses and proves to be a significant piece for social progress.

INTRODUCTION

The modern, popularized concept of opera remains rooted in antiquated thoughts related to the elitist air and intimidation surrounding the art form. Stereotypical aesthetics of opera include period costumes, grand opera houses, red velvet curtains, ornate gold molding, a full orchestra, and booming vibrato. Opera is more than the superficial aspects that lure an audience in, it is also an art form that combines the efforts of music, acting, stagecraft, and literature in order to bring a story to life on stage. These stories often reflect and comment on problems in society in order to comment on the nature of humanity. Nowadays, opera is no more than a niche interest that produces countless iterations of productions steeped in the Western Classical canon. This paper will explore 19th-century exoticized French opera and alternative sexuality through the analysis of a single opera: *Les pêcheurs de perles* (*The Pearl Fishers*), composed by Georges Bizet, with libretto by Eugene Cormon and Michel Carré.

Although not Bizet's most well-known opera, *Les pêcheurs de perles* is performed enough to be known within the operatic world. The opera is set in ancient times on the island of Ceylon (present-day Sri Lanka), a faraway, exotic land to French audiences in 1863. Orientalism and exoticism are practices popularized during the Romantic era in Europe, and I use them here interchangeably as they encapsulate the same concept: orientalism falls within the broader category of exoticism and specifically references Asian cultures (Locke 2001). These practices found ways to illustrate the grandeurs of foreign lands, particularly Asian and African cultures. They also appropriated, simplified, and othered those cultures. France was one such nation in the 19th-century whose cultural output was fixated on the tantalizing allure of exoticism.

During this time, France's central role for women was a maternal, family-oriented position. Homosexuality, though decriminalized a century prior, was still socially unacceptable. In an act of national critique, Georges Bizet's deliberate, exoticist take of Ceylon paralleled France's bigoted societal norms and views through his opera, *Les pêcheurs de perles* by reframing the issue of the domestication of women and the elusiveness of alternative sexuality within society's preconception of exotic cultures.

SYNOPSIS

Les pêcheurs de perles revolves around three main characters: Zurga, Nadir, and Leïla. Zurga and Nadir are men who are best friends. They were both romantically interested in Leïla before they lived in Ceylon, but neither of them won her over, and their fruitless pursuit strained their friendship.
Ceylon is occupied by a community of villagers who are primarily fishermen. They fish for pearls as their main source of trade. The villagers are Hindu and have a high priest, Nourabad, at the local temple. Despite being Hindu, the villagers are illustrated as a superstitious community through their ceremonial and ritualistic practices for getting rid of evil spirits that affect the weather and the yield of pearls.

The opera itself begins with a move to make the 'backwards' community more 'progressive' and 'liberal' by installing Zurga as the leader of the community—a change from a cooperative community to one with a designated leader (a power structure reminiscent of European nations and their colonies). Soon after, Nadir enters, and Zurga and Nadir reminisce on their quarrel in the past, renounce their love of Leïla, and swear upon their devotion to their friendship.

The villagers, plagued by turbulent weather, have decided that their ceremonial dancing is not enough to keep the spirits at bay and have a virgin Hindu priestess (whom we will later discover is Leïla) come to the island to sing prayers to the god Brahma in order to protect the community. She is sent to live at the nearby temple, and, out of curiosity, Nadir follows her. At the temple, Leïla prays aloud and Nadir recognizes her by her voice. He talks to her, and they decide to reignite their passion for each other, with Leïla choosing to use her voice to sing to her beloved instead of to Brahma.

In the second act, Leïla confides her fear of being alone to the high priest, Nourabad, and he reminds her that she must remain courageous and give everything to Brahma, even if Brahma asks for her death. She relates a childhood memory of her bravery in keeping a fugitive safe and keeping the locket that the fugitive gave her. Nourabad leaves and Nadir enters. Wary of Nourabad being close by and any wandering ears, Leïla tries in vain to get Nadir to stay quiet or leave, and they end up singing a passionate duet. To no surprise, Nadir is caught on his way out of the temple by some of the fishermen, and they demand the deaths of Nadir and the now impure priestess. Zurga arrives to hear the commotion and instead offers them grace and reprieve by sparing their lives and exiling them from the island. On Nadir and Leïla's departure, Nourabad removes the priestess' veil, revealing her identity to Zurga as his former love interest, the very one that Zurga and Nadir swore to leave in

their past. Out of rage and jealousy, Zurga sentences them both to death.

In the final act, Leïla pleads for Nadir's life even at the sacrifice of her own. Zurga confesses his love, refuses to offer mercy, and is rejected by Leïla. Leïla gives her necklace to Zurga, recounting the story of protecting a fugitive, and is taken to her execution at the prepared funeral pyre. Upon sight of the necklace, Zurga realizes that Leïla is the child who protected him when he was on the run. Understanding that the fishermen will no longer let Leïla and Nadir leave unharmed, Zurga lights the village on fire and comes to the funeral pyre in order to warn the fishermen of the fire. The fishermen leave to rescue their homes, and Zurga frees Leïla and Nadir. Zurga informs Leïla that he was the fugitive that she rescued, and the opera ends with Zurga alone, waiting for the return of the fishermen.

DOMESTICATION AND SEXUALIZATION

In 19th-century France, the separate spheres model was in full swing, with women solely confined to the private sphere (Popiel 2009). Many intellectuals during this time relied on the role of maternity as a source of instilling values in the next generation within the household and church alike (Popiel 2009). A similar reverence for female sacrifice and devotion emerges in the character of Leila, whose solitary prayers secured the survival of Ceylon. Nadir's role as the 'selfless' hero who sweeps her away represents two things: the objectification of women and the imposition of French colonialism as a form of saviorism. Leïla was never in danger and had no need for Nadir to save her, but she also never had a choice in her role as a priestess.

Trapped within the temple, Leïla sings her aria, "O Dieu Brahma," in which she begins a prayer to Brahma, Siva, and the nature spirits around her. The melody remains within the key, B♭ major, but with more embellishments within the opera's music thus far. The most notable difference would be the triplet rhythm that is seen in the melody, which is not unexpected as triplet and dotted rhythms are typical for French music. The choir—soprano, tenor, and bass voices—echo Leïla. After her prayer, the meter morphs from 9/8 to 6/8 and marks a new section which is adorned with accidentals, as her impassioned prayer reflects the imagery invoked by the text. Instead of echoing Leïla, the tenors and basses[1] encourage and spur her as she enters the climax of this aria with a melismatic passage on a simple [a] vowel. Swiftly after her aria, Nadir, her love interest, recognizes her voice and joins her in a

1 Traditionally masculine voice parts that I will refer to as being 'men' in order to leave room for gender fluidity

duet, and they end the piece together.

The use of Leïla's purity at the beginning of her aria coupled with the 'male' chorus' encouragement of her pleasure in the second section illustrates the objectification and fetishization of the East by the West. The first section has a medley of voices backing Leïla, and there is a large emphasis on groupings of three: three dotted quarter notes to a measure, the triplet figure in the melody, subjects repeated three times, and three groups in the choir.

In Western culture, we commonly see the number three within divine settings in Christianity, such as the Father, Son, and Holy Spirit, but it is also a significant divine number in Hinduism. In Hinduism, the number three is significant in *puja*, a worship ritual used in devotional practices, where water is passed around a fire three times during the *aachman*, the ritualistic act of drinking water to cure and cleanse oneself (Persad 2020). In Hinduism, there are also three planes of existence: *bhu*, *bhuvah*, and *swah* (Persad 2020). Whether Bizet utilized a Christian or Hindu approach, this holy imagery exemplifies Leïla as pure, untouched, and devout.

The second section, with its impassioned accidentals and ornamentation, marks a contrast with the first. Here the soprano voices drop out, leaving us with the 'men' as they encourage her to be free with her voice:

Ah! chante, chante encore.	Ah! keep singing, keep singing!
Oui, que ta voix sonore,	Yes, let your voice ring out
Ah! Que ton chant léger,	Ah! Let your gentle song
Loin de nous, chasse tout danger!	Drive away every peril!
(Bizet 1893)	

Spurred on by the 'men,' she enters a melismatic and heavily ornamented passage. The 'men' continue to accompany her during this passage with the same lyrics beneath her melody. The constant presence of the men perpetuates the male gaze and the performative nature of both the piece and entire opera as a whole.

Nadir and Leïla's duet evokes the damsel-in-distress-and-knight-in-shining-armor trope while the voyeuristic 'male' chorus sings beneath them, encouraging and delighting in the story as it unfolds. Leïla sings of her love for Nadir while he sings of his valiant efforts to protect her. This duet seems as though it should be an intimate moment due to the lyrical content, but the 'male' chorus is still singing despite their part being completely covered by the orchestral parts. The presence of the male chorus creates a voyeuristic depth to the scene through the exoticized narrative of an innocent, untouched woman being saved by a courageous man, unafraid of the backlash from her culture.

PUBLIC OPINION

The depiction of the male chorus acting as an audience during Leïla's aria is a meta depiction of the way Western cultures indulge themselves with stories and characters from the East. This mirroring results in the depiction of the French audience as voyeurs who entertain themselves with inflated stories with exotic backgrounds. The entire story exoticizes a culture that French society viewed as 'backwards' and 'conservative.' As such, the audience likely viewed the scene as a fun night at the opera as opposed to a reflection of their current social and political situation. The repeated lyrics from the 'male' chorus reflect the reductive consumption of exoticized narratives within French society.

Faced with the underlying satirization of French exoticism, Parisian periodicals *Le Menestrel* and *Revue et Gazette Musicale de Paris* condemned Bizet's work on the grounds of the cacophonic orchestral texture and overbearing dynamic intensity: "We agreed that it was too noisy, too colorful and tiring to hear,"[2] and "Except for the few passages that we mentioned earlier, and which there are exceptions, the instrumental and vocal storm roars from one beginning to end in this terrible opera,"[3] respectively. The European and colonial response of these Parisian music journals display their distaste for the opera when it does not fit the categorical mold of exoticized Romantic operas, like Delibes' *Lakmé*. The coupled use of exotic musical material with the self-referential and self-critical setting of the music and plot left French audiences uneasy with the reflection of their cultural subconscious, colonial and misogynistic mindset. Due to this unease, *Le Menestrel* and *Revue et Gazette Musicale de Paris* reduced the music, and as a result, the plot and message, to nothing but extraneous noise.

The harsh reactions from these two periodicals demonstrate the strong compositional choices that Bizet made in his opera. The intentionality behind the music and story lends itself to repulse or garner the admiration of the public. Given that Bizet wrote an opera for one of Paris's leading opera houses, it would be expected for him to write a work that would enamor the public and music periodicals. The fact that Bizet went ahead and premiered *Les pêcheurs de perles* in this form allows us to believe that there are themes in

2 "On s'est accordé à le trouver trop bruyant, trop charge de couleur, et d'une audition fatigante" from *Le Menestrel* (Bertrand 1863)

3 "Sauf les quelques passages que nous avons mentionnés tout à l'heure, et qui font exception, la tempête instrumentale et vocale mugit d'un bout à l'autre de ce terrible opéra" from *Revue et Gazette Musicale de Paris* (Durocher 1863)

the opera that he wanted the public to discuss in tandem with the discourse on his compositional choices.

The repulsion of Bizet's work provides multiple layers of subconscious commentary regarding foreign cultures and the domestic sphere. The Western world fetishizes the East in an idealist and sexualized manner while condemning the express degradation of foreign cultures, a reflection of France's cultural subconscious. Through this scene alone, Bizet created a tableau that illustrates the inequitable narrative which reflected the realities of colonial projects and women.

THE CLOSEKNIT RELATIONSHIP BETWEEN ALTERNATIVE SEXUALITY AND EXOTICISM

In much French music of the 19th century, including opera, alternative sexuality and exoticism go hand in hand.[4] This sense of the other culture allows for 'taboo' concepts to be explored freely. This can be seen with homosexuality in France and how it is depicted in Bizet's *Les pêcheurs de perles* within Nadir and Zurga's relationship.

Maxime A. Foerster's concept of "heterosexual trouble" from his 2012 doctoral dissertation, "French Romanticism and the Reinvention of Love," discerns the difference between heteronormativity and alternative sexuality within Romantic French literature. Foerster describes heterosexual trouble as the resistance of heteronormativity by a heterosexual couple through rejection or failure, thus subverting the expectation and ease of heteronormativity (Foerster 2012). Foerster's dissertation uses philosopher Michel Foucault's thought that literature compensates what language can not transparently do (2012). Foerster's concept of heterosexual trouble surfaces in this opera in that Nadir and Zurga's romantic heterosexual endeavors routinely fail. As a result of their failed heterosexual endeavors and their adamant rejection of having future romantic heterosexual relationships come between them, they become an idiomatic portrayal of heterosexual trouble.

Romantic French operas have a tendency to include duets between a baritone and a tenor—two traditionally masculine voice types—that feature lyrical content on their enduring friendship, faithfulness, and fealty. Such ideas even appear in France's motto, "*liberté, egalité, fraternité*," which trans-

4 See "Orientalism" by Edward Said, "French Orientalism: Culture, Politics, and the Imagined Other" by Hosford and Wojtkowski.

lates to "liberty, equality, fraternity." Brotherhood and community are important concepts in French culture. Following that logic, there is no reason that one would have against the concept of French opera's male friendship duets; however, operatic duets in other European traditions are traditionally used for romantic and intimate moments, as the overlapping harmonies illustrate intimacy and unity.

Nadir and Zurga's 'friendship' duet illustrates Eve Kosofsky Sedgwick's concept of "homosocial desire" from her 2016 book, *Between Men: English Literature and Male Homosocial Desire*, which discusses the dichotomy in male and female homosocial relationships. We see female homosocial relationships as fully-fleshed and reciprocated where women love women through supporting, uplifting, and promoting other women (Sedgwick 2016). In contrast, the male homosocial relationship serves to promote and uphold the patriarchy, which requires the perpetuation of homophobia to promote heterosexual relationships and the power dynamics that result (Sedgwick 2016). Sedgwick's homosocial desire comes into play with Nadir and Zurga as the depiction of their homosocial relationship is plagued with seeds of doubt to maintain the illusion of heteronormativity.

Like a grand piece of literature, Georges Bizet's opera *Les pêcheurs de perles* is full of nuances that bring out queer subtleties through his understanding of exoticism in the greater societal scheme. Bizet promotes alternative sexuality through the subversion of French values and heteronormativity in Nadir and Zurga's friendship duet, "Au fond du temple saint."

The duet begins with Nadir and Zurga reminiscing over their shared love interest, Leïla, at the temple where they paint an image of her beauty and allure, heightened by her veiled visage and obscurity. The A section begins in 4/4; 4/4 is typically written with a symbol that is referred to as 'common' time. As a result of the regularity of this meter, it can be perceived as being set to a traditional concept, just as how heterosexuality is normalized and seen as 'common.' After this establishment of normalcy, Nadir and Zurga recall their former love for Leïla and both of their hands repel away from each other as they turn into enemies:

> NADIR Ta main repousse ma main!
> ZURGA Ta main repousse ma main!
> NADIR De nos cœurs l'amour s'empare
> Et nous change en ennemis! (Bizet 1893)

The heterosexual trouble that arises from this situation lies within their struggle to secure a romantic, heterosexual relationship with Leïla. A ferma-

ta[5] interrupts their idealization of heteronormativity and Zurga realizes that this idea is nothing but a faint rumble in the background like the dismissable and trembling tremolo[6] beneath them.

In the B section, the music changes from common time to triple meter with sextuplet rhythms playing in the orchestra as the two exclaim that nothing will separate them:

> ZURGA Non, que rien ne nous sépare!
> NADIR Non, rien! (Bizet 1893)

This short, contrasting section is marked by a meter change and a key change. These modulations represent not only a musical shift but also an attitude shift for the both of them as they continue to repeat the text. They continuously repeat that nothing will separate them over and over again, declaring their devotion and loyalty to one another—something that one would typically say to assuage and calm their lover. This is symbolic of their homosocial desire for each other as they begin to declare their fealty to one another.

Another peculiar musical change is the embedded groupings of three, both in the meter and in the combined grouping and repetition of two triplet figures. Recalling the importance of the number three and its divine symbolism both in Christianity and Hinduism, the music illustrates that Nadir and Zurga's queer relationship is anything but common; rather it is holy.

Their transcendence beyond the standard conventions of a patriarchal society emerges not only via meter and rhythm, but also through changes to the key. The A and A′ sections are both in E♭ major and depict heteronormative yet troubled heterosexual pursuits between Nadir and Zurga whereas the clearly defined B section is written in C major and explores the homosocial desires between the two. These sections foil each other as two distinct lines of thinking from a homosocial and a heterosexual perspective.

This passage is quickly tamed as the tremolo comes back with a new line of dialogue in which Zurga and Nadir swear to be friends, with the cadence returning to E♭ major and common time as they transition back to a variant of the opening A section. Despite this return to conventionality, Bizet manages to add in sprinklings of doubt to their strong 'platonic' relationship where they vow their undying fealty to each other:

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5 A sustained pause in the music

6 A note that is played in a trembling manner

C'est elle, c'est la déesse	Great Goddess, Heaven descended,
Qui vient en ce jour nous unir!	she today has led you to me!
Oui, partageons le même sort,	Now we shall tread one single path,
Soyons unis jusqu'à la mort!	never again to part till death!
(Bizet 1893)	

In contrast to the A section, where Nadir and Zurga reminisce upon their pursuit of Leïla, the two complete each other's sentences in order to retell the story together and conclude the A′ section by singing together in unison. This harmony in thinking and mindset further develops the queerness within their relationship as well as cements their homosocial desire for one another. This moment is also an establishment of heterosexual trouble as they are essentially casting off women or, at the very least, saying that no women will get in the way of their friendship as Leïla has in the past.

In the second section, the musical lines are repeated between the two as echoes of one another, and even when they are supposed to be in unison, the lines have their own distinct rhythmic differences, yet they still complete phrases together. This depiction shows that the memory of Leïla was a rehearsed story, but the last section evokes more of a true relationship where their individuality and impromptu thoughts are apparent and complementary.

The vagueness of whether the duet's theme underscores friendship or intimacy creates a queer subtext. This is especially apparent when looking at the line, "Comme un frère je veux te chérir!" which translates to "like a brother, I will cherish you," but only Nadir says that lyric in its entirety. Zurga, on the other hand says, "Je veux te chérir!" which translates to "I will cherish you!" This leaves reasonable doubt for the audience and society to dismiss the nuanced message of their homosocial relationship and to subject it to societal norm and the value of fraternity. This seed of doubt is present in order to achieve a false illusion of heteronormativity that unravels when given deeper thought and reflection. Once again, their homosocial desire for one another arises in a manner that blurs heteronormativity.

Finishing up the duet, the A′ section of the music illustrates the longing for Leïla, who is veiled and remains in the shadow, a fantasy that cannot be seen. This longing to belong and adhere to societal norms comes out through the music and plot as Zurga and Nadir chase an illusion of normalcy that they can never reach, thus cementing the rehearsed play of heteronormativity in the A section as a guise for Zurga's hidden feelings. Understanding that the both of them loving the same woman will only lead to pain, they set aside their intimate feelings from the B section and return to heteronormativity

in the A′ section. Their true feelings are portrayed through an act of heterosexual trouble, but the need to conform to heteronormativity is illustrated through the repercussions of homosocial desire. Zurga's desire to cherish Nadir comes into light as he would rather maintain his relationship with him than to lose him completely.

As Act III unfolds, Zurga is torn apart with guilt that he has sentenced Nadir to death, constantly referring to him as a childhood friend, whereas he briefly mentions Leïla only as being beautiful. In solitude, he asks for forgiveness of the passions of an angry heart. His love for Leïla always seems to be an afterthought addition to the libretto. When Leïla comes to plead for Nadir's life, Zurga confesses that, like Nadir, he loves Leïla, but he refuses her pleas and notes that her desire to save him is what ultimately condemned him. But as we know, in the end, Zurga saves them by lighting the houses of the villagers on fire in order to free them without suspicion.

Once again, these seeds of reasonable doubt help to achieve a sense of heteronormativity, but Zurga's actions are akin to a tempestuous teenager in the face of unrequited love. What could be more queer than loving one's childhood best friend who just happens to be the same sex? Then, just like a child, someone else wants what the other person has, and they either have to give it away or destroy it, so that no one can have it, so Zurga sentences Nadir to death. If he can't have Nadir, then he'll take away what he loves and try to swoon Leïla, but when that he can't have either, he angrily decides that they will still be put to death. Calming down and realizing his irrationality, he decides to be even crazier and light the town on fire just to let his dreams of love go: "Rêves d'amours! Adieu!" (Bizet 1893).

Note the use of rêve in its plural form. Why would the librettist use the plural form of "dreams," if Zurga was not talking about both Leila and Nadir, especially when the singular form would be pronounced the same way?

Rêves d'amours!
[ˈrɛ vɘ da ˈmur]

Rêve d'amour!
[ˈrɛ vɘ da ˈmur]

If his only love was Leïla then the singular form would be fitting, and the audience would not know any better, but the addition of a singular 's' changes the whole meaning.

CONCLUSION

By setting up a story full of exoticism, Bizet employed various compositional techniques to heighten the alternative sexuality that was present in the existing libretto of *Les pêcheurs de perles*. By closely examining the libretto and the score, we find that the story follows Zurga, a queer individual, and his romantic fixation with Nadir, his childhood friend, in their 'friendship' aria, "Au fond du temple saint." They play into societal norms of heteronormativity but illustrate moments of heterosexual trouble in order to subvert traditional social and sexual concepts. As the opera continues, Zurga's frustrations of unrequited love continue to grow to the point where he condemns Nadir and Leïla to death. But in the final moments of the opera, Nadir chooses to release his unrequited lovers. The combination of alternative sexuality, exoticism, and the use of *Les pêcheurs de perles* as parallelization of France creates a palatable opera for 19th-century French audiences with strong indications of mirroring and critiquing their society.

Georges Bizet's *Les pêcheurs de perles* was a satirical representation of 19th-century France that was easily dismissed by the public through his employment of popular styles such as exoticisation and the male 'friendship' duet. The opera has moments where it behaves as a play within a play as seen in Leïla's aria, "O Dieu Brahma," which illustrates the inequitable realities of being a woman subjugated into the domestic sphere and white saviorism within colonialism. This voyeuristic presentation of the opera in the 'friendship' duet, "Au fond du temple saint," illustrates inhibited queer feelings. Zurga's hidden homosexual feelings are stifled through nuanced distinctions within the text and music throughout the opera. Bizet masterfully deals with the hidden social and political problems within alternative sexuality and separate spheres in 19th-century France by paralleling the Western narrative within an exoticised Eastern narrative in his opera.

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02

Pushed to the Edge: Homeland Outcasts

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BIOGRAPHY

Julia Palmer received a Bachelor of Arts in History in summer 2023 along with a creative writing minor, Secondary Social Studies Education, and Honors College certificate. She had been a Humanities Scholar since freshman year. Julia was published in the fiction section for Bartleby, and presented twice at URCAD freshman and senior year. She completed her last course in an intensive two-week creative writing course at the University of Wales, Trinity Saint David. Receiving the URCAD award, following the course, she traveled throughout the UK, then ended travels in the Daintree Rainforest for a guided tour. The tour brought a personal connection and holistic outlook on her research and writing. She would like to acknowledge the support and guidance of her advisors, Dr. Mirjam Voerkelius and Dr. Tania Lizarazo. Presently, Julia teaches 8th Grade American History for Baltimore County Public Schools while continuing to write creatively in her free time.

RESEARCH JOURNEY

Research began with my History 497 course, a thesis study which focused on the history of international food. The professor, Dr. Mirjam Voerkelius, worked alongside me to create a vision of my paper and the sources to rely upon. We met in-person throughout the semester to continually rework entries of George Robinson, who wrote almost daily on interactions and travels with Natives. He included valuable information on the foodways of groups living in various terrains. His perspective also provided an understanding on the attempted indoctrination of Native religion and culture, which underpinned the subsequent forced assimilation. By the end of my research, I came to the conclusion that British colonization was founded on the inferior perspective of Native livelihood. Overlooking the beauty and resilience of a livelihood that is starkly different from the fast-paced world around us.

ABSTRACT

This paper examines the impact of British colonization on present Australian Aboriginal diet and health. Two crucial timelines are included in this paper. The first follows the foodways of the Natives, with evidence of lingering foodways present today. The second describes the increased presence and power of the British government, specifically in policies relating to Aboriginals. The research questions grounding this paper are, how did British colonization marginalize and displace Aboriginals? In what ways did the diet for Aboriginals change due to British colonization? And, what are the health concerns Aboriginals are suffering as a result of colonization? My paper is in conversation with much ongoing research that focuses on the impact of colonial policies for Native populations worldwide. At-home research included modern-day footage and interviews of Aboriginals. I relied mainly on present-day sources for Aboriginal perspectives as much of their knowledge had been traditionally spread via word-of-mouth. British writers were also utilized with their description of Native foodways. Most highlighted the biases which were used to justify disproportionate British policies. The final piece of research included the information and conversations of the food tour with my guide who spoke about colonial policies and their impact on his family.

INTRODUCTION

"They took our land and gave us God," he told me with a side smile, walking barefoot in the sand, carrying a spear in one hand and an upside-down crab in the other. In late July 2023, I spent the day with Juan Walker, a cultural food tour guide of the **Kuku Yalanji** Aboriginals in Northern Queensland, Australia.[i] Juan's line of God and land is a common saying in his community. Although sarcastic and lighthearted, it speaks volumes of the sly justification of British colonization in the hopes of expanding their ideals of civilization founded in Christianity and the Industrial Revolution. British colonization, which began in 1788 and ended in 1901, remains a fresh wound in the many minds and lives of Aboriginals throughout Australia. In their conquest, the British sought to destroy the fabric of religion and lifestyle in Native communities. Following 1901, the Australian government, in place of British rule, continued to lack Aboriginal political representation and voice, producing policies to treat them as outcasts in their own land. This paper will tell the story of British colonization in Australia with its consequences, up to the present, on the diet and health of Aboriginals.

I had traveled to Mossman, Queensland, for the all-day diet tour. As I had gathered from my research, the tour proved the close link between the food and culture of Aboriginals. Juan navigated our group through the mangroves and forest to demonstrate hunting and gathering techniques. He spoke of the rainforest as "**Marrja**" (Madjah) which translates to boss. In this relationship, everyone in the community learns to listen to the forest while being equal to each other. Such cultural practices and social structures had been attacked through the forced assimilation of the British government, which will be discussed in detail in later sections.

The location of Aboriginals mainly outside of major cities is common knowledge to many white Australians, yet their traditional culture is, for the most part, unknown.[ii] Aboriginals only make up three percent of Australia's total population but are about one-third of the Northern Territory (NT) population, which many would know as the Outback. The popular image of the NT is the Uluru, a magnificent rock monolith. In 1985, the land was officially granted to the **Anangu** people, who have leased it to the government for joint management and care. Beyond its physical beauty, the Aboriginals hold deep spiritual sentiment for the natural formation.[iii]

On the plane ride to Australia, I mentioned my research to a young man from Perth, Western Australia. He quickly responded with the common trope that Aboriginals "live off the land." But how do they live off the land? And have these ways remained the same or changed over time, especially with

the disruption of colonization? For the NT, the geography includes much desert. Many would question if living in the desert is viable, but the land provides more than what may meet the modern eye. Author Pat Lowe lived in the Great Sandy Desert for three years with Jimmy Pike of the **Walmajarri** people. Pike co-wrote Lowe's published chapter on their shared experience, while Lowe is featured in Pike's artistic pieces. While together, Lowe witnessed the intimate connection between Pike and the land; the story she includes is his ability to find her car keys in the midst of the open desert. Pike's outlook and sentiment for the desert is present in his desert landscapes that meld both physical and supernatural space through the presence of spiritual beings.[iv] Lowe wrote about the land being subtle, revealing itself gradually, only "known intimately by the people who truly belong there."[v] In this, Lowe recognizes and celebrates the survival of Aboriginal culture which has continued to be passed down orally, despite colonization efforts and objectives on the land and lives of Aboriginals.

In 2021, Australia's Human Development Index (HDI) scored 0.951 out of 1.0, being fifth out of 191 countries worldwide.[vi] This score is extremely high, considering its placement above high-GDP countries such as the United States, Canada, and the United Kingdom. HDI reflects life expectancy, education, and income, all of which measure the prosperity of the average citizen. Australia does experience the benefits of Western development, however such statistics neglect to reflect the unequal standard of those in Aboriginal communities.[vii] Medical research today evidences inequality specifically in the health issues and food deserts plaguing Aboriginal communities.[viii] These include cardiovascular disease, cancer, type 2 diabetes, and kidney disease. Disparity exists due to food in Aboriginal settlements being subject to higher prices, limited supply infrastructure, and treacherous transportation routes today.

In their history, Aboriginals are not alone but have shared a similar fate to the Native population of Canada. Both follow a similar timeline and explanation for the events. In his research, Jon Johnson describes the impact of colonization in forcing Aboriginals to be dependent on unhealthy aspects of Western dietary practices and forcibly removed from native dietary culture. The change brought obesity, diabetes, and cardiovascular disease. In his analysis, he includes the revitalization of native cookbooks to acknowledge the survival and growth of native culture, which Aboriginal Australians have done as well.[ix] With the evidence of colonization practices, I will argue similarly that rather than being from poor individual choice, diet-induced diseases in Aboriginal communities are rooted in the disproportionate access to goods and services provided to them by the Australian government.[x]

FOODWAYS OF AUSTRALIA'S FIRST PEOPLES

FUNDAMENTAL SPIRITUAL BELIEFS

Aboriginals define the traditional relationship to nature as both interactive and sacred. From my gatherings of different language groups, the creation story called "Dreamtime" holds the basis for spiritualism of life and nature. A brief outline of this story, provided by the Aboriginal Art Association of Australia, speaks on spirit ancestors who made humans and local plants and animals. Humans were also said to be the direct descendants of ancestral beings who taught them the necessary skills of hunting, building, and gathering, in order to utilize the land for survival.[xi] Although specifics of the story vary, as there were "500 or more Aboriginal languages and groups across ancient Australia," the concept of humans, animals, and plants being spiritually connected is uniform.[xii] Oral stories strengthened the spirituality with enduring traditions of receiving food and life from nature.[xiii] Up to the present, Aboriginal ancestral knowledge has survived. Juan would tell our group that everything one could need is found in nature.

FIGURE 1
Guided Tour through Daintree Rainforest

In line with the rainforest being named "**Boss**," it is multi-functional as a home, pharmacy, etc. In the Daintree Rainforest, Juan pointed out plants and insects with their health benefits. The first was a white chalk-like substance beneath tree bark. He dragged his finger across and licked it, telling us of its use for treating headaches. Deeper in the forest, Juan pointed to green ants scurrying around moss and twigs. He picked up a bunch and crushed them between his fingers, explaining that they were useful for clearing sinuses. He ate some and then invited us to join him, so I mirrored him and bit down on them. They were sour to the taste like candy, and a couple bit my lip because I did not crush all of them. I giggled, as my food usually does not bite back at me. Although not entirely sure of the ants, I trusted Juan. He learned all his knowledge and skills from family and implemented many in his daily life. He seemed to thoroughly enjoy living in these ancestral ways and sharing them with new people.

NATIVE ENVIRONMENTAL CONSCIOUSNESS: HUNTING

Spirituality of foodways is still present with the environmental concerns of Aboriginals. During the time of colonization, British missionary George Robinson noted the food consciousness of Aboriginals on the island of Tasmania. While eating, they would not waste any animal parts. With wallabies and other large animals, "they skin [them] with shells or a piece of glass bottle … very fond of the entrails which they eat half raw."[xiv] For both hunting and gathering, Aboriginals do not extract beyond necessity, and especially not waste what has been taken.

The Aboriginals have been rewarded by the Australian government for their environmentalism as they are the only people allowed to continue hunting turtle, which are an endangered species. One Aboriginal describes the rationale, "Our grandfathers and great, great grandfathers taught us from generation to generation. To eat the food from the land and from the sea […] We are limiting the catch. In one expedition, maybe two or three turtles […] people are aware of the turtle and the fact that their numbers are going down."[xv] Juan mentioned this right to turtle hunting as well. He described the scarcity of the turtle, and that overhunting does not occur in Aboriginal communities. In his parents' backyard, Juan showed our group a hollow turtle shell that had been painted bright colors. He said that people partake in eating turtle during large events such as weddings, birthdays, and funerals. Similar to pre-colonization, meals are divided between people and all the meat is used. Besides turtle cooking, kangaroo cooking resembles the com-

munal practice of using all the meat. In a video of the **Pia Wadjarri** people of Western Australia, eating kangaroo is a large community event and there are various ways to cook the different parts for a stew.[xvi] Such dietary and hunting practices that remain today are highly respected and environmentally friendly, which allow hunting rights to Aboriginals beyond the general population.

NATIVE ENVIRONMENTAL CONSCIOUSNESS: GATHERING

Similar to hunting, Aboriginals are historically documented to be conscious in gathering as well. In 1831, British explorer William Ellwood observed Aboriginals choosing food "with short maturation rates, such as grass seeds, nuts, fish and insects …[from this] it is believed that overexploitation is almost impossible."[xvii] A current spokesman for Aboriginals, Yakar Garimala, reasons this food practice with their spirituality. He explains that if nature is mistreated, "before long she [nature] will get angry and attack you in one way or another."[xviii] With food, Aboriginals saw how their actions would impact the world their current future generations must live in. The conscientiousness in both hunting and gathering reflects the honor Aboriginals hold for nature and their desire for its long-term presence.

HUNTING AND GATHERING DIET: PRE AND POST-COLONIZATION

The diet of various Australian Aboriginals depended upon the region in which they lived, landscapes which ranged from desert to coastland. Nevertheless, there were common characteristics throughout language groups such as optimizing the offerings of the land and sharing the reaping as a community. For one, most language groups were split with women and children as gatherers and men as hunters. One particular tribe of note is that of the **Mewite** people who lived in the Arnhem Land along the coast of Northeastern Australia. This tribe had been filmed by The British Board of Censors in the mid-20th century. The film creates assumptions that the tribe will "eat anything catchable" along with various other biased assumptions, which cannot be fully trusted as the film is embedded with racist remarks, even with the title *Primitive People*.[xix, xx] Yet, it cannot be assumed that the Aboriginals lacked thoughtfulness in their foodways. Evidence that will be in focus later speaks against this, as hunting and gathering built upon ancestral knowledge and intelligence.

Filtering through the narration and focusing on the actual film of the

Aboriginals, the gathering and hunting practices are clearly witnessed.[xxi] Gatherers would search for shellfish and crabs within the reef, wild honey within dead trees, yams and roots, grubs, and small animals. Hunters in this area would spearfish and search for animals on land, such as pythons. Robinson mentions similar in his notes of Port Davey Natives. The women were "great adepts in swimming. It surprised me to see them plunge into the heavy breakers among the rocks … for crawfish and mutton-fish."[xxii] From this story, it should be noted that a great amount of physical strength and intelligence were needed for both hunters and gatherers within communities.

Such dangers in daily life meant that survival depended on calculated risks and mutual trust to reap despite the possibility of death. Even today dangers are faced, as seen when an unspecified NT group is filmed hunting poisonous stingrays off the coast. To catch them, the hunter impales them, then holds their tail in their mouth to pull out the poisonous sting. Afterward, they maul them to death and carry the stingray over their shoulder to shore.[xxiii] For the **Mewite** people, before eating food, they would gather all the food and divide it evenly to roast over a fire. In a more recent documentary, the communal practice of turtle hunting and eating was also shown. When caught, the turtle is divided as an elder ensures that everyone gets a share.[xxiv] The turtle is highly sought after, and its eggs are considered a treat, typically found by children who follow a trail and dig them out of the sand.[xxv] Although not all knowledge of every group is documented through writing in pre-colonization times, there are certain characteristics which have remained throughout the disruption of colonization. Such techniques, with the risks that remain today, brought continued survival and made interdependence necessary for a successful day of collection without injury.

COMMUNAL LIVING AND PRACTICES

Along with the spiritual connection of food to Aboriginals, there is also a deep communal aspect of living, with each person needing to fulfill their role in community survival. In various language groups, it was common for members to sleep next to each other to keep warm near the fire, as the documentary footage proved.[xxvi] In Robinson's travels to Port Davey, he finished his journal entry with "the natives as usual came and lay close to me."[xxvii] Their inclusion of Robinson within their close community exemplifies that their bonds went beyond the nuclear family towards those living amongst them. Today, this community mindset remains evident in Aboriginal homes. One modern mixed family in Sydney is noted as having a home "almost always crowded with aunts, cousins, and nephews who randomly drop in."[xxviii]

Additionally, in Juan's family, cousins would live in their home during school months, having more than ten family members in the house at the same time. The physical affection, the welcoming atmosphere, and the dependability of Aboriginal families is rooted in their history of food practices in which food is shared and each person has a specific role.

ANCESTRAL KNOWLEDGE: TECHNOLOGY AND TECHNIQUES

Besides the immense courage and environmental knowledge possessed by various Aboriginals, there is also engineering evidence of their foodways that can be revealed with scientific evidence. Hunters and gatherers not only ate from what they could find; they also manipulated land for a better yield with hunting technology and agricultural techniques. Aboriginals held knowledge of tide patterns and prepared their nets in waterways for better yields of fish. This had been discovered by an archaeological excavation led by Peter Coutts, in South-Western Victoria. They discovered fish traps in the Northern Territory, Western Australia, South Australia, and New South Wales, as well as basalt stone races, walls, and canals which could change a fish's trajectory to go into set traps.[xxix] Such technologies allowed them to effectively catch eel, Australian smelt, blackfish, native trout, and more.

For animal hunting, Aboriginals utilized a practice called firestick burning. Firestick burning is the intentional burning of undesirable vegetation such as scrub. The fire frightens and forces kangaroos into the position of being speared. The knowledge of natural patterns and animal behavior allowed Aboriginals to control them for survival. Initial British onlookers to Australia took much notice of fire burning, as it was a regular occurrence. In 1853, a visitor to Port Essington wrote in the middle of the dry season, "the conflagration spreads until the whole country, as far as the eye can reach, is in a grand and brilliant illumination."[xxx] British painter Joseph Lycett took particular notice of the fires, drawing descriptive landscapes for people in England to gain an image of the new land. In his painting *Working the Land*, the viewer clearly sees Aboriginals carrying spears to hunt kangaroos which had been drawn out by the fire (Figure 2).[xxxi] Although Lycett took artistic liberties, making the artwork "more like English parkland than antipodean bush scenes," nevertheless, the crucial relationship between the purposeful fire and spear hunting is not lost in time.[xxxii] Fire was a dependable resource for a more stable hunting gain, as were the fish traps, agricultural practices, and designated roles. All gave more yield control to Aboriginals. Such Native practices evidence the immense knowledge of Aboriginals on the intricate environment of Australia, in relation to both plants and animals.

FIGURE 2
Working the Land by Joseph Lycett, National Library of Australia

Along with the use of technology for more effective hunting, there is evidence that natives preserved their foods. British observer, William Ellwood, took note of this in the Northern Territory and Western Australia. He described natives "wrapping the foods in grass and then applying a coating of mud, which allowed storage for up to 18 months."[xxxiii] For another method of lengthening food supply, natives made cereal out of "somulga seeds, dried yams, ngardu (Marsila quadrifolia), caterpillar flour, dried fish and fowl."[xxxiv] In the South-West, Ellwood evidenced farming in the land as there were three and a half miles of warran plants next to each other. Such planting would not naturally be in such an order.[xxxv] Such practices were sophisticated methods which curated a more predictable and stable food supply.

The above evidence proves the immense knowledge Aboriginals had of the land and its resources that lent to survival. There are some hunting and gathering practices which remained post-colonization. However, the relocation, reeducation, and the dominance of British colonization stole the land and therefore the connection between Aboriginals and foodways. In order to understand the immense impact of colonization on the intricate livelihood of Aboriginals, it is crucial to understand the history of British colonization, specifically how it began and fought against the living traditions of the Natives.

TIMELINE OF BRITISH CONTROL IN COLONIZATION

FIRST ENCOUNTERS WITH ABORIGINALS

In 1770, one of the first British arrivals, Captain James Cook, landed his crew in New South Wales (South-East Australia) on a mission to gain as much information as possible for the British Crown. This included knowledge on the minerals, fishes, animals, and most importantly, the people,[xxxvi] to measure the possible benefit of colonizing the land. On his trip, Cook claimed the east coast for Britain, naming it Possession Island. At this point, it was known that Natives lived on the land, but the knowledge of the number of people and language groups was unclear to the explorers. They decided the population was to be completely overlooked in line of claiming the land for England. Cook, in observing the Aboriginals found "they are far more happier than we Europeans; being wholy [sic] unacquainted … [with the] conveniencies [sic] so much sought after in Europe … They live in a Tranquility which not disturb'd [sic] by the Inequality of the Condition."[xxxvii] The subject of study and colonization, Aboriginals from 1770 onwards, would never have the same life prior to colonization when land claims were their own.

More than a decade after Captain Cook's trip, Captain Arthur Phillip arrived in 1787. Right away, settlement in Australia began, and the British presence grew. Phillip and citizens who arrived on subsequent trips were unanimous in their bias of Aboriginals as lesser humans. Even scientific officials contributed extreme racism in their fabricated observations. For example, naturalist George Caley wrote in 1809, "the natives of New South Wales are the most idle, wretched and miserable beings in the world."[xxxviii] The surgeon George Worgan, who accompanied Captain Cook, found it difficult "to touch one of them, for they are Ugly to Disgust."[xxxix] Along with violence, foreign diseases spread quickly amongst Aboriginals, and both cut the Aboriginal population down significantly. In 1835, British Governor Richard Bourke of New South Wales made a proclamation which declared *terra nullius* on Australian land, which translates to the land having no owner. With this proclamation, Aboriginals had no possession of land, and were now regarded as "trespassers," as all land belonged to "the Crown."[xl] Without the legal rights to the land, Aboriginals lost their ability to carry on food practices they had taught and practiced.

ECONOMIC PROSPERITY FOR THE BRITISH

In the mid-1820s on Tasmania, an island off the coast of New South Wales, Natives came close to full annihilation during British settlement and expansion. Natives on the island fought in sporadic attacks against British settlers who encroached on their land. The violence back and forth received the name "The Black War," despite resembling more of a genocide. The evidence for arguing about the label of genocide comes from the debates within the government committee for Aboriginals at the time. During the conflict, the committee sought approaches to remove Aboriginals from the land to allow for the expansion of pastoralism by British settlers.[xli, xlii] Aboriginals were seen as an inconvenience, and their struggle for self-protection and land ownership was categorized as sin, blamed on a supposed "wanton [deliberately violent] and savage spirit."[xliii]

The end of the conflict is credited to missionary George Robinson. In the painting *The Conciliation*, Robinson is in the center with luminescent colors on his skin and clothes (Figure 3). Beside him, is an Aboriginal leader, shaking his hand to symbolize the deal between the two. Aboriginals would relocate with Robinson to Flinders Island under British authority. Such surrender for proposed safety came with the price of cultural autonomy. The sacrifice of freedom is protested by the Aboriginals to the right pointing to a

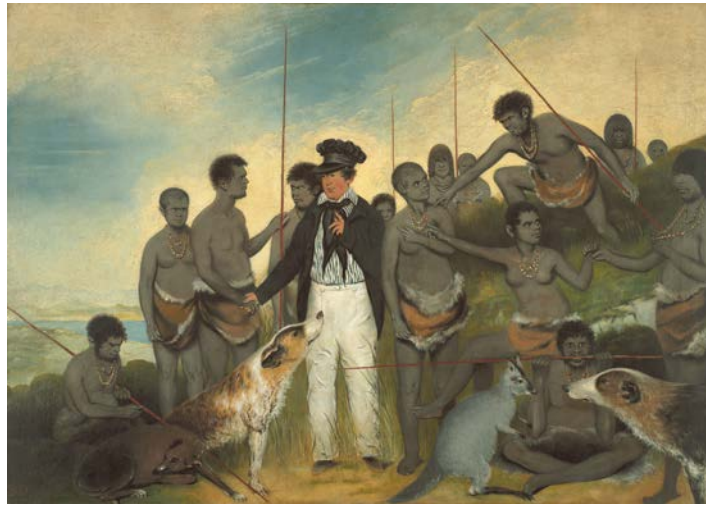

FIGURE 3

The Conciliation by Benjamin Duterrau, Tasmanian Museum and Art Gallery

cultural necklace.[xliv] All the Aboriginals are wearing this necklace except for the leader making the group's decision with Robinson. In actuality, Robinson did not work towards the interests of Aboriginals, but rather the interests of Governor Arthur to support British settlement on Tasmania.[xlv] The promise of safety was mere words. Although Robinson did lead out fifty Aboriginals, many died along the journey. If they did survive, their government-sanctioned land resembled more of a "permanent offshore detention."[xlvi]

The end of The Black War did not equate to an end of British atrocities against Aboriginals.[xlvii] Power in politics and society grew for settlers and diminished for Aboriginals. In the words of *The Augustus* in 1856, "We have made them outcasts on their own land, and are rapidly consigned [sic] them to entire annihilation."[xlviii] British takeover of the continent required genocide to annihilate any opposition or physical struggle from the Aboriginals. Once the land was in their possession, development came without restraint. Varying strongly from Native land cultivation, the British began to introduce shepherding and cattle raising, while also banning Native fire burning practices. In 1804 Aboriginals appealed to the Governor King, crying as they were being "driven from the few places that were left on the banks of the river, where alone they could procure food."[xlix] Despite the deep history and connection Aboriginals held to the land, their cries were repeatedly ignored. The monetary gain for Britain outweighed the environmental and humanitarian costs of such settlement. Robert Dawson, agent of the Australian Agriculture Company, wrote, "had the original settlers been men of business … the colony would have been in a very different condition to what it is at the present moment."[l] Dawson, in line with the mindset of colonization, saw the land's value wholly in terms of monetary profit and worldwide trade. Thus, preserving land rights for Indigenous use and growth was not the slightest concern for the British government.

BRITISH ENVIRONMENTAL DESTRUCTION

As the British replaced Aboriginals as caretakers of the land, they farmed the land as they would in England itself. This introduced troublesome practices neither fit nor beneficial for the ecosystem. For pastoralism, sheep hooves destroyed local grasses evolved for soft-footed and light-pressure kangaroos. This combined with sheep grazing disrupted the surface water and groundwater supply, along with degrading the soil.[li] There were accounts of flooding, erosion, and decreased rainfall.[lii] Sheep thrived in Australia, growing thicker wool and dying of fewer diseases than those in England. A feedback cycle resulted as sheep farming became increasingly profitable and widespread,

in turn bringing more damage to the land and loss of space for Aboriginals to live. On November 13, 1847, the *Sydney Atlas* described such events: "the sheep runs … [have] nearly swept the grass clean out of sight, in the space of twenty years […] the very roots torn out and eaten, at last she [Mother Nature] retired exhausted."[liii] The original landscape and water cycle could not continue under the harsh intrusion. Ignoring the signs of environmental damage, settlers continued sheep grazing. When exhausting the grass of one area, they would simply move to another to maintain business.[liv] Aboriginals continued to be silenced in the decisions of the government land use. It took until 1976 when Aboriginals received land claims to engage in practices such as fire burning again.[lv]

The objective and practice of *terra nullius*, from the start of British contact, expanded with land titles being a simple process with limited government regulation on development. In particular, the construction of railroads during the 1870s and 1880s was for councilmen who owned Australian property, which meant decisions were made for their own personal profit.[lvi] British takeover of Australia went beyond land ownership, with the spreading of ideas of themselves as the rightful owners of the land through systematic forced integration of Aboriginals. Not only were Aboriginals relocated for the objectives of the British, without rights and voice, but they were also indoctrinated with British ideas, such as settlers being the rightful owners of the land. In this, the British held the same mentality as American integration of Native Americans with the goal to "kill the Indian in him, and save the man."[lvii] Britain had been on a "civilizing" mission, which included the attempt of erasing Aboriginal culture from not only land practices, but also the minds of present and future Aboriginals. Thus, with physical and societal encroachment, the British sought to transform the island of Australia to be an extension of their own.

FORCED CULTURAL ASSIMILATION

SPIRITUAL FOUNDATIONS: SUPERIORITY COMPLEX

One of the foundations of colonization was the fervently felt need for evangelism, the act of coercing people to join Christianity. Christianity is not only monotheistic, but also regards all other religions as invalid. Evangelism created a superiority complex in colonizers, viewing Native spiritual practices as heathen, dishonorable, and deserving of eternal punishment orchestrated by God. At the time, Christianity was the official religion of England and without a division between church and the state, the actions of both were

intertwined. As such, missionaries and church leaders drove colonization efforts in Australia through forced assimilation of Natives that aligned with the dogma of the Bible and the lifestyle practices of the English. This section will explore the timeline of forced assimilation of Natives and the strong role of religion.

The initial contact of the English included that of missionaries. One of note is George Robinson, who wrote the ironically titled book, *The Friendly Mission*. Robinson left detailed notes of his years living alongside the Aboriginals, much of which include his religious sentiment and bias. Robinson's approach towards Natives came from his perspective of them as "degraded of the human species" and in dire need of understanding the only "true faith."[lviii, lix] Robinson's main goal of connecting with Aboriginals was to first instill his perceived civilized practices and second the Christian religion.[lx] He hoped both would transform Aboriginal communities to be easy neighbors with settlers in order to force "habits of industry [that …] strangers visiting the settlement would see more to interest them and be induced to settle."[lxi] Besides forcing lifestyle practices onto Aboriginals, Robinson attempted to convince them to "substitute in their place feelings of sorrow and remorse for their past barbarities, a grateful sense for present favours and benefits, and a new appreciation of those blessings conferred upon them through the medium of their persecuted Christian deliverers."[lxii] Robinson here expresses a manipulation tactic, comparing colonization to the physical manifestation of God's kingdom spreading. In this line of thought, atrocities should not only be ignored but embraced by Aboriginals. Native attacks against such development and people of "goodwill" would be categorized as sinful, evil, and most of all, ungrateful. Christianity rationalized colonization efforts, disguising any effort for expansion as good and worthy of blessing. Nonetheless, the claims of spreading goodness could never overwrite the destruction of colonization presently impacting Aboriginals.

The efforts of Robinson were similar to his predecessors, who manifested the Christian message beyond conversion to penetrate the lives of Aboriginals and attempt to guilt them into contentment while being victims of the brutal system of expansion. The relationship between Aboriginals and leadership, whether with missionaries or in allotted settlements, was known as paternalism. Such a relationship includes complete submission to designated leaders, outlined in the New Testament with congregants and pastors.[lxiii] In this vein of understanding, obeying God included obeying those who claimed to be his messengers.

MISSIONS: STRANGERS ON STOLEN LAND

Disguised as goodwill for provision and protection, allotted government settlements for Aboriginals known as "Missions" capitalized on colonization goals through containment, control, and indoctrination of Aboriginals. The growing encroachment of settlers forced many Aboriginals to live on Missions that were under the authority of church officials. In a brief timeline by historian Richard Bloome, if the difficulties in settlements "became unbearable in the early years, they could simply leave for a while. This option became unavailable as [settlement] grew immensely and pastoralists drove people off their runs."[lxiv] Although the land was for Natives, all power was given to church officials who were not chosen by residents. If abuse or mismanagement occurred, Aboriginals were not recognized as official citizens nor equal residents who could take legal action.[lxv] For present and future generations, strong rebellion could not occur as punishments were severe. Additionally, there was dependence on the Missions as Aboriginals could no longer survive in the changing world around them.[lxvi] Distance from the land and traditional culture with independent foodways began to be endangered for future generations.

DIFFERENCES IN UNDERSTANDING THE SUPERNATURAL

Leadership controlled not only where Aboriginals lived but how they would live. Power was claimed in the physical world inhabited, along with a spiritual realm where good and evil existed. This dynamic claimed by leadership is perfectly exemplified by one punishment, lecturing Aboriginals continually while they were "strapped [unable to leave] for impudence and bad language."[lxvii] Those who were chastened not only received a physical punishment of being immobile, but also were told they committed a spiritual wrong that would attempt to induce guilt and condemnation. The objective of leadership was to control the ethics in Missions. Yet the morality was socially based on British culture, categorizing Aboriginal culture as wrong and in need of eradication. The teachings were an outside system for the Aboriginals and with both language and cultural differences, communicating and implementing values was far from simple.

Besides the common occurrence of mistranslations, there were also major themes of the two spiritualities that were based on completely different kinds of meaning.[lxviii] The core creation understanding, "Dreamtime," did not lend well to the nature of sin, hell, and redemption found in the Bible. Many church leaders found these differences in language and religion to be a deficit

for those in Native communities. However, the confusion experienced by Aboriginals is simple to see from the unaccommodating, forceful, and uninvited approaches of missionaries. For example, when shown "biblical pictures, they [Aboriginals] saw a white God, a white Jesus, white angels and a black Devil – a colour [color] symbolism of white as good and black as evil,"[lxix] Being taught by white messengers emphasized the meaning of color even more, as the reoccurring message of the gospel to Aboriginals was a need to change in order to be good and a child of god. Such simple mishaps occurred without foresight as White messengers were accustomed to Western audiences. Sermons and teaching of spirituality of good and evil were difficult, but smaller lessons on money and possessions were also difficult as Aboriginals held different concepts and value on such systems.[lxx] Without the same language, societal structure, economy, and personal ambition, Natives differed strongly from the usual audience of preachers.

Although not the norm for missionaries, Friedrich Albrecht changed his perspective on Native spiritualism after years of connecting with Aboriginals. While first assuming them to not possess any religion, he came to believe them as "among the most religious people in the world."[lxxi] The story of Albrecht's conversion, in the opposite manner than intended, exemplifies that value for religion depends solely on the observer. Although touching, Albrecht remained a minority in the missionary efforts of Australia. Despite goodwill from him and a few others, it could not be enough to stop the immense atrocities that were rooted in British expansion. The stronghold of missions and proselytizing Aboriginal spiritual practices distanced future generations from ancestral traditions.

A SMALL PLACE IN WESTERN ECONOMY

During our tour, Juan mentioned the Mossman Gorge Mission where his grandmother had been a forced resident, learning the skills and trades for subservient work in the outside economy. The history of the Mission dates to a goldrush in 1876 that skyrocketed settlement and drove destruction to the rainforest and Daintree River.[lxxii] In 1889, the newspaper *The Premier* wrote that loss of land had "driven [Aboriginals] to starvation, which forced them to steal food."[lxxiii] Hardships did not end once they joined Missions, as Aboriginals were forced to labor in designated roles. Even if they were successful with work on Missions, many Aboriginals were not supported nor encouraged to leave for independence. They were taught that the outside world would be full of "temptations and difficulties."[lxxiv] Outcasts in their own land, Aboriginals were "lost in a white man's world" without a say in their own future.[lxxv]

For the residents allowed to leave, roles forced upon them were specifically designed for inferior work positions in the Western economy being established. Beginning at the age of fourteen, all residents had to complete their designated role to earn daily food rations.[lxxvi] Such food rations were withheld as punishment for any action deemed wrong. Throughout adulthood, authorities treated and spoke to the residents as children, which "eroded their former autonomy" with the attack on family practices, economy, diet, language, and religion within Missions.[lxxvii] Missions questioned the label of "residents" for Aboriginals and more so lends to the title of "inmates," which Richard Bloome uses in his discussion, as they were forced to labor without real pay nor choice.

PARENTING OF THE STATE

Conversion on Missions was more difficult with adults than children. This made raising children in Christian ideals a priority for Missions, as there was a higher chance for their understanding of social ideals. The government pre- and post-colonization authorized laws for human rights to be taken from individual Aboriginals and given to the government to control. It escalated to the point where children became property of the state. In Broome, this process began under the Western Australia Aborigines Act of 1905, as children were brought to reserves without parental consent.[lxxviii] The act expanded to the rest of Australia with The Aborigines Protection Act of 1909 being amended in 1915. This allowed the state to biasedly determine whether children were being properly cared for; if thought not, then they would be forced to live on Missions. Nevertheless, the oversight of care and rights for children living under the state was not a concern. Children were also cut off from their natural-born communities, not having the freedom to live with them again until adulthood.[lxxix] Colloquially known as "The Stolen Generation" these children remain a memory in discussion today, as some still live or have told stories to their living children. Final estimates are that about one in three Aboriginal children were taken.[lxxx]

The increased power of the state decreased the influence and connection between Aboriginal children and their natural families. Living in dormitories allowed leaders to have absolute control over the children's daily lives and activities. There were packed daily schedules with many religious customs and specified gendered work with, "domestic work for girls and stationhand [agricultural] skills for boys."[lxxxi] Traditional connection to the land fostered and nurtured by family was blatantly attacked, as the state took possession of children for their own cultivated future of Australia. Besides

living away from family, there were many practices of the boarding schools that fostered distance between children and communities. For one, young men were prevented from participating in initiation ceremonies with their elders. Additionally, young girls planned to be married off within their communities were bought, raised, and sold to Christian boys when they were old enough by church leaders.[lxxxii] The separation of children and their families mirrored the widening division of Aboriginals to land. With the blatant cultural attack in designated lands, the languages of Aboriginals diminished as well. Juan told me that 250 languages survive today, whereas there were about 800 pre-colonization. Encroachment on the right to parent children evidences the uncontrollable power of the British government on Aboriginal livelihood. Like the physical destruction in colonization, attempting to force Aboriginals into a curated British society created a tumultuous aftermath for Aboriginals to survive within.

PRESENT DIVISIONS IN ABORIGINAL COMMUNITIES

FOOD DESERTS IN ABORIGINAL COMMUNITIES: PRESENT HEALTH STATISTICS

Today, due to the infrastructure and colonized displacement of Aboriginal communities, they are dependent on food from major Australian cities. Beyond the difficulties in transportation, poverty in these communities profoundly impacts the food options and consequences on health. According to the Health and Humans Rights Journal in 2016, "ATSI (Aboriginal and Torres-Strait Islander) peoples living in remote areas, [are] 36% are [more] likely [than non-ATSI peoples] to run out of food" due to lack of funds.[lxxxiii] Thus, food supply is in a dire situation, as the average Aboriginal on welfare would have to spend close to forty percent of their income to buy food for proper nutrition.[lxxxiv] With the majority of Indigenous community members living on low-income jobs, this sacrifice would cut into money needed for other necessities.

In a study from 2010-2011 on grocery store purchases in three different NT villages, the Australian Medical Journal determined the daily nutrition of villagers. With the immense distance, food prices are 45% more than food in the capital of Darwin. In turn, highly processed foods are purchased in bulk at

lower costs, as preservation is easier for long distances.[lxxxv] In addition to the cost, there is the issue of vulnerability to natural disasters such as tornadoes and unpredictable weather conditions that could disrupt food transportation. In such a situation, the last resort would be packaged and frozen food found in the remote communities.[lxxxvi] Due to these circumstances, the current Aboriginal diet involves foods that are high in caloric intake and poor in nutrients, which contrasts greatly with their previous diet wholly dependent on local plants and animals.[lxxxvii] Food transportation and reduced stock of Aboriginal stores have ultimately created food deserts, areas which are void or carry limited supply of affordable and healthy food options.

The study sought to support previous studies which have "consistently reported low intake of fruit and vegetables, high intake of refined cereals and sugars, excessive sodium intake, and limited availability of several key macronutrients." [lxxxviii] The study on the three NT villages strengthened such assessments, finding Aboriginals going above the recommended daily sugar intake with significant contribution from sugar-sweetened beverages. For the tested communities "sugars contributed 25.7%-34.3% of dietary energy," whereas the average Australian receives 10.9% dietary energy from sugar.[lxxxix, xc] Calculating these statistics, the average Aboriginal consumes almost triple the amount of sugar as the average Australian. An additional concern with the macronutrients is protein being the main one lacking, despite its cruciality for development and energy in a person. In its place, the main macronutrient is sourced from fortified white bread made up of about 50% carbohydrates.[xci] These dietary findings from the villages cannot be solely blamed on personal choices but rather on the constraints of food availability. The concerns in diet lead to concerns in health for the people in these communities.

HEALTH STATISTICS: COMPARING THE AVERAGE ABORIGINAL TO NON-ABORIGINAL

Compared to non-Indigenous communities, the average life expectancy for Aboriginals is ten years less.[xcii] The reasons for this are, "chronic diseases [which have been] estimated to account for 80% of the mortality gap between ATSI (Aboriginals and Torres Strait Islanders) and non-Indigenous Australians aged 35-71." [xciii] Such chronic diseases include "cardiovascular disease, cancer, and type 2 diabetes," all of which can be highly impacted by diet and lead to premature death.[xciv] One disease in particular, kidney disease, is causing great distress for Aboriginal communities. The disease decreases the kidneys' ability to function, which is a vital function of the body to filter blood for bodily needs. Kidney disease can lead to complete failure and loss of life.

The most intensive intervention for improperly functioning kidneys is dialysis treatment, which normally occurs about three times a week for three to four hours. Treatment is typically not available in remote settlements, which means many have to relocate for survival.[xcv] Kidney disease is highly impacted by diet, exercise, and lifestyle. Early lifestyle intervention could lengthen one's life and slow the progression of the disease. Defined as an epidemic by researchers, Aboriginals have died from kidney disease at a rate of 5.1 times more than non-Natives in the years 2004-2008. Treatment for kidney disease is more prevalent, as they frequent the hospital eleven times more than the non-indigenous population from 2011 to 2012.[xcvi] The lack of resources for treatment and preventative lifestyle measures the inadequate structure and supplies available for Aboriginals to be as prosperous as the outside population.

CHANGE NEEDED IN PROGRAMS FOR ABORIGINAL COMMUNITIES

To improve the health and diet in Aboriginal communities, immediate intervention is needed, as this is a time-sensitive issue. Programs and initiatives have begun to address the health issues experienced by Indigenous communities in the sectors of food supply and nutritional education. One Australian government program, "Close the Gap," seeks to bridge health averages of Indigenous and non-Indigenous populations, while including Aboriginals as contributors.[xcvii] Specifically, the program seeks educational awareness in nutrition and practices of healthy eating. However, in a commentary by Dr. Deanna Davy of the University of Sydney, she argues that the program is insufficient as there has been strong popular criticism. The program falls short of demanding that "indigenous communities [need] access to the same level of services and facilities that non-Indigenous Australians have."[xcviii] In other words, food inequality will require more than a short-term solution; it demands a complete refocus of the government's priorities and structures. Aboriginals are to be treated with equal services and protections as the rest of Australian citizens. The suffering in these communities is not self-induced but rather the result of colonization; first being separated from ancestral foodways and secondarily being dependent on poor availability of Western food. As such, it is the government's responsibility to implement solutions, beyond spoken apologies for past actions.

Another main critique of Dr. Davy on governmental programs is specifically those who manage stores without Indigenous involvement. The emphasis and need for Aboriginal-run programs are crucial, especially for

nutritional education. Many on the outside may not understand the difficulty of food supply and financial stress, which make food choice more complicated with other priorities and needs on hand.[xcix] Additionally, Aboriginals have the opportunity to incorporate past foodways, which had been successful for their ancestors. However, this is not the norm. Certain programs, such as "Outback Stores," will only give support to those who relinquish control to the government. The stores operated and supported by the government are successful, thriving with lower food prices, better organization, and a stronger connection to outside communities. Although these stores do benefit from the intervention, the locally run stores that refuse intervention experience severe difficulties in business.[c] On a similar note, the welfare system also lacks fair communication with Natives. To begin, it is not accepted at local stores that are not government-controlled. Secondly, the welfare cannot be used in personal discretion. Money is allotted to particular categories, called "welfare quarantining."[ci] This becomes a problem if, for example, someone had immediate needs for car repairs. It is vital to work to maintain ancestral foodways of traveling for hunting and gathering needs.[cii] To address the specific needs of each Aboriginal community there needs to be communication and power for the individual recipients.

SUCCESS IN PARTICULAR ORGANIZATIONS: HEALTH

In spite of drawbacks within certain restorative programs, there has been noted success with the few that do collaborate with locals on their needs and desire for development. "Outback Stores" have been a productive community resource, providing a variety of healthier foods for locals.[ciii] They have not taken over whole community operations, but have instead provided the means for healthier food options in already present stores. In a similar vein, "The Purple Truck" provides crucial care that is welcomed by Native communities. The truck travels to provide dialysis treatment for a couple of days in remote regions. The truck allows Aboriginals who had to move to major cities to receive necessary care, to visit loved ones they had to leave behind.[civ] Despite the benefit of "The Purple Truck" Aboriginal communities continue to be in dire need of improved health intervention as dialysis patients are increasing at a rate of nine percent annually.[cv]

SUCCESS IN PARTICULAR ORGANIZATIONS: ENVIRONMENT

Much of Aboriginal knowledge on the land and its reaping was not acknowledged, respected, or incorporated into the government during and af-

ter colonization. Treating the land as British land, continued to devastate the environment, which did not become a national concern until it impacted their own. Between 2019 and 2020, ravenous wildfires that claimed forty-six million acres and claiming over 450 lives, marked the time in Australia as "The Black Summer."[cvi, cvii] In response, the Australian government took a second look at traditional Aboriginal fire burning. In a documentary following the development of fire practices, Australian fireman Barry Child comments, "I am worried that we have been doing the wrong thing for some time, I definitely converted to the idea of cultural burning as a key resource for us."[cviii] Currently, a popular advocate of fire burning is Aboriginal Victor Steffenson. Steffenson produces films and books on the legitimacy of fire burning and its necessity to control massive wildfires. He educates outsiders on the beauty of controlled fires as it allows people to participate in nature and its benefit to healthy cycles and seasons. Without human-induced fire burning, unplanned and uncontrollable wildfires can wreak havoc on Australia as "The Black Summer" proved. One momentous motion has been officially crediting rights to the **Kakadu** people as park rangers to facilitate fire burning practices (located in the NT).[cix] Instead of first assuming that fire burning is unpredictable and solely for thrills, the perspective has shifted to seeing the mass benefit of hearing ancient Aboriginal knowledge for survival. On land officially owned by the Australian government, the Aboriginals continue to be the ones who intimately know the ground as those who truly belong.[cx] With this small success, large gaps are yet to be taken beyond fire burning: much Aboriginal knowledge of land, foodways, language, and spirituality should continue to be supported, strengthened, encouraged, and acknowledged by the nation, and not delayed until a problem that can no longer be ignored arises.

CONCLUSION

Following the food tour in Queensland I explored major Australian cities, Melbourne and Sydney (Figure 4). To my surprise, the cities resembled the United States more than Europe. The structure of the cities and highways were familiar to me from the East Coast. The buildings were taller than those in Europe and dotted with various familiar chain stores. The roads were wide and multi-laned, with larger vehicles similar to those found in America. Among the commercialization of the cities, I noticed signs acknowledging Native land rights on various buses, streets, and public buildings. The admittance of faults was envisioned by Governor General Sir Deane in 1996. He argued that reconciliation between Natives and the government, would be

unachievable without proper recognition of wrongs from the past.[cxi] After my research and experience with Juan in the Daintree Forest, I wondered whether these words were the beginning or end of progress. The fast world I had walked around could never slow down nor reverse to become the land before colonization. The words of acknowledgement merely held a reminder that the financial success of Western capitalism surrounding me came through the loss of land and livelihood of many.

FIGURE 4
Downtown Sydney

NOTES

i Juan explained to our group that Aboriginals do not use the title of "tribe" for labeling language groups in different areas of Australia. Tribe had been a colonized term to separate and identify the Aboriginals throughout Australia. For racial categories in Australia, Aboriginals are described as "Black". It is important to note that the First Peoples did not have power in such labels and categories. For the purpose of this paper, Aboriginals, Natives, and Indigenes are interchangeable terms for identifying the First Peoples of Australia, in contrast to settlers and colonizers originating from Europe. I predominantly use the term Aboriginals, as they themselves speak the term colloquially to describe themselves and communities.

ii Eric Ellena, "Dreamtime Travelling [sic] Through the Australian Continent," French Connection Films, Boomerang Productions and Voyage, Video, 1:00, https://www.youtube.com/watch?v=OnWGXMDhwi8. https://www.jstor.org/stable/pdf/j.ctt2jbjbt.9.pdf?refreqid=-excelsior%3Ac89ca63c205e-936e5317fbc28f38099d&ab_segments=&origin=&acceptTC=1.

iii "Handback of Uluru to the Anangu People," Defining Moments, National Museum of Australia, https://www.nma.gov.au/defining-moments/resources/uluru-handback-anangu#:~:text=Handing%20back%20Uluru,deeds%20to%20Uluru%E2%80%93Kata%20Tjuta.

iv "Jimmy Pike," Collection, Australian Institute of Aboriginal and Torres Strait Islander Studies, https://aiatsis.gov.au/collection/featured-collections/jimmy-pike#toc-life-in-the-desert-pat-lowe-and-jimmy-pike.

v Jimmy Pike and Pat Lowe, "You call it desert –we used to live there," in Dislocating the Frontier: Essaying the Mystique of the Outback, ed. Deborah Rose and Richard Davis, 93.

vi "Human Development Insights," Human Development Reports, https://hdr.undp.org/data-center/country-insights#/ranks.

vii Christina Pollard, "Selecting Interventions for Food Security in Remote IndigenousCommunities," in Food Security in Australia: Challenges and Prospects for the Future, ed. Quentin Farmar-Bowers and Vaughan Higgins. (New York: Spring Science and Business Media, January 2013), 98.

viii Edward Small, "For Australian Aborigines, the Health Problems of Westernization," The Atlantic, November 8, 2012, https://www.theatlantic.com/health/archive/2012/11/for-australian-aborigines-the-health-problems-of-westernization/265281/.

ix Monica Bodirsky and Jon Johnson, "Decolonizing Diet: Healing by Reclaiming Traditional Indigenous Foodways," The Journal of Canadian Food Culture 1, no. 1 (Nov. 17, 2008), doi: https://doi.org/10.7202/019373ar.

x Julie Brimblecombe, Megan Ferguson, et al., "Characteristics of the Community-Level Diet of Aboriginal People in Remote Northern Australia," Medical Journal of Australia 198, no. 7 (2013): 380, doi: 10.5694/mja12.11407.

xi "Aboriginal Dreamtime," Aboriginal Art Gallery, Aboriginal Art Association of Australia, https://www.aboriginal-art-australia.com/aboriginal-art-library/aboriginal-dreamtime/#:~:text=Dreamtime%20is%20the%20foundation%20of,world%20as%20they%20knew%20it.

xii Richard Bloome, Aboriginal Australian: A History Since 1788, (Sydney: Allen and Unwin, 2019), pg. 5.

xiii "Full Documentary. The Men of Fifth World - Planet Doc Full Documentaries," YouTube, 5:30, August 2, 2014, https://www.youtube.com/watch?v=-1Td-8VUcKk0.

xiv George Augustus Robinson, Friendly Mission (Launceston: Queen Victoria Museum and Art Gallery and Quintus Publishing, 2008), 60.

xv "Dreamtime Travelling [sic] Through the Australian Continent," 20:39.

xvi "Eating Kangaroo with Aboriginals," Filmed by Gareth Leonard, Video, 6:16, October 12, 2016, https://www.youtube.com/watch?v=0mGL5-iAPBg.

xvii William Ellwood, et. al., "Agricultural Hunter-gatherers: Food-getting, Domestication and Farming in Pre- Colonial Australia," 115, James Cook University, https://researchonline.jcu.edu.au/27882/1/ellwood_etal_2009.pdf.

xviii "Full Documentary. The Men of Fifth World - Planet Doc Full Documentaries," 22:46.

xix "Primitive People - Australian Aboriginals," British Board of Film Censors, Produced by Ralph Smart, Filmed by George Heath, Commentated by Peter Finch, 1950s, Video, 10:00, https://www.youtube.com/watch?v=ZNIPX-a5USZE&t=1105s.

xx The oral tradition for Aboriginals spreading information, limits information on particular subjects to those who documented written reports or video footage, from the outside. This made discernment between truth and assumptions crucial for research.

xxi "Primitive People - Australian Aboriginals," 10:06.

xxii Robinson, 166.

xxiii "Full Documentary. The Men of Fifth World - Planet Doc Full Documentaries," 28:07

xxiv Full Documentary." The Men of Fifth World - Planet Doc Full Documentaries," 39:03.

xxv "Dreamtime Travelling [sic] Through the Australian Continent," 19:58.

xxvi Ibid.

xxvii Robinson, Friendly Mission, 176.

xxviii "Dreamtime Travelling [sic]...," 33:37.

xxix Coutts, P. J. F., et al., "Aboriginal Engineers of the Western District, Victoria" Records of the Victorian Archeological Survey 7, (June 1978): 28.

xxx Rhys Jones, "Fire-Stick Farming" Fire Ecology 8, (2012): 6, doi: 10.1007/BF03400623.

xxxi As with many of the British artists for Aboriginals, Joseph Lycett got sent to Australia as a prisoner. Lycett got released from his sentence because his artwork impressed the government with ones, such as Working the Land, being published in England upon returning home. "Lycett, Joseph," Australian Dictionary of Biography, 1967, https://adb.anu.edu.au/biography/lycett-joseph-2382.

xxxii Ibid.

xxxiii William Ellwood, "Agricultural Hunter-gatherers ...," 119.

xxxiii Ibid.

xxxv Ibid, 118.

xxxvi PDF transcription in, "Special Instructions to Lieutenant Cook 30 July 1768 (UK), Documenting a Democracy, Museum of Australian Democracy, https://www.foundingdocs.gov.au/item-did-34.html.

xxxvii "James Cook's Endeavor Journal," National Library of Australia, August 23, 1770, https://www.nla.gov.au/digital-classroom/senior-secondary/cook-and-pacific/indigenous-responses-cook-and-his- voyage/james.

xxxviii Stuart Banner, "Why Terra Nullius? Anthropology and Property Law in Early Australia," Law and History Review 23, no. 1 (2005): 105.

xxxix Ibid, 106.

xl PDF transcription in, Governor Bourke's Proclamation 1835 (UK), Documenting a Democracy, Museum of Australian Democracy, https://www.foundingdocs.gov.au/item-did-42.html.

xli Lyndall Ryan, The Aboriginal Tasmanians, (London: University of Queensland Press, 1981), 84.

xlii Ibid, 107.

xliii Ibid.

xliv Andrew Trounson, "Helping Us to See," Dec. 18, 2021, University of Melbourne, https://pursuit.unimelb.edu.au/articles/helping-us-to-see-when-we-don-t-want-to-look.

xlv Trounson, "Helping Us to See."

xlvi Lyndall Ryan, The Aboriginal Tasmanian, 112.

xlvii Sally Engle Merry, "Law and Colonialism," Law and Society Review 25, no. 4 (1991): 890.

xlviii Ibid.

xlix Stuart Banner, "Why Terra Nullius? Anthropology and Property Law in Early Australia," Law and History Review 23, no. 1 (2005): 115.

l Robert Dawson, The Present State of Australia (London: Smith, Elder, and Co., Cornhill,1831), 425.

li Ibid, 65.

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03

Investigating the Role of Actin57B Gene on Age-Related Changes in Immune Response

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BIOGRAPHY

Yamini Ravi is a senior Bioinformatics and Computational Biology major, and she will be graduating in May 2024. Her post graduate plans include pursuing a PhD in Immunology. Yamini would like to thank Dr. Leips and his lab members for their support and guidance throughout her time at UMBC. The Project this paper is based on is partially funded by the URA.

Ellie Ober is a senior Biological Sciences and Sociology double major. She will be graduating in May 2024. She is a member of STEM BUILD Cohort 6 and aspires to become a professional researcher in molecular biology and genetics. Ellie would like to thank Dr. Leips and the Leips lab for all of their encouragement.

RESEARCH JOURNEY

YAMINI RAVI

I have always wanted to learn more about the actual science behind all things that happen in the world, and in college, I was able to further my curiosity by joining the Leips Lab. I originally learned about the lab from Dr. Leips when I took his class in my freshman year, spring semester. I reached out to Dr. Leips and got this amazing opportunity to work in the lab and learn lab techniques along with other skills that are generally not taught in classes. Joining this lab opened a wide array of options for me, including what I hope is my future career. I also experienced the joys and struggles of the process of research. The last two years have given me so many experiences, and I would like to thank Dr. Leips and his lab for the golden opportunity.

ELLIE OBER

I have been fascinated by life at a molecular level since high school and find immense fulfillment in hands-on experiences. After returning to campus from the pandemic, I was so grateful to have my first opportunity to combine these into an extremely fruitful research experience within the lab of Dr. Jeff Leips. This lab has offered me a

great community of supportive and passionate individuals who have pushed me to pursue further research opportunities and develop my career as a professional scientist. This project is the culmination of many great successes and many hours of trial and error. I am so proud of what it has become. I would like to thank Dr. Leips for the incredible opportunity to perform research in his lab and also the entire Leips lab for their help and advice.

ABSTRACT

The age-related decline in the innate immune response, or immunosenescence, is highly variable among eukaryotes and has been shown to have a genetic basis. Using *Drosophila melanogaster* as the model organism, previous studies have identified several candidate genes that could affect an organism's infection clearance ability. One of the genes identified is *Actin57B*, which is upregulated in older flies. This gene has been studied for its involvement in embryonic muscle development, but little is known about its role in the innate immune response. To assess the role of *Actin57B* in immune response, we knocked down its expression in hemocytes using the Gal4/UAS system in *Drosophila melanogaster* to activate RNA interference against the gene. To evaluate the immune response, one and five week old flies were injected with an *E. coli* solution and were given 24-hours to recover and clear the infection. The surviving flies were homogenized and plated on agar plates. The resulting bacterial colonies were counted and used as the phenotype that reflects the remaining infection. Through measuring the impact of *Actin57B* on the innate immune response, our results will validate findings that this gene contributes to immunity and aid in the development of more effective, personalized therapeutics to improve healthspan.

INTRODUCTION

As the population rapidly ages, especially in a post-pandemic world, it is vital for public health to identify immunotherapy targets so that treatments can be developed, particularly for the elderly. In this project, the concept of senescence is used as the foundation for understanding the different effects the aging process has on the immune response. This project focuses on immunosenescence, the decline in immune function with age, because it is the hallmark of aging in many species, including humans (Leips 2019, Aiello et al. 2019). While most organisms exhibit age-related decline in immune function, the rate of decline with age varies across species (Peters A. et al. 2019) and across individuals within a species, and this variation has been shown to have a genetic basis (Lesser et al. 2006, Felix et al. 2012). This project aims to find the relation between the genetic variation in the fruit fly *Drosophila melanogaster (D. melanogaster)* and immunosenescence by using *Escherichia coli* (*E. coli*) to examine the effect of a specific gene, *Actin 57B* (*Act57B*) on the ability of flies to clear infection. Further research on this gene is a potential gateway to understanding its effects on the human immune system.

D. melanogaster is an effective model organism for studying the aging process with a short lifespan of two to three months. The flies also have a short life cycle, going from egg to adult in two weeks. The short lifespan allows us to study the effects of genes throughout the lifespan. In addition, sixty percent of the genes in the *D. melanogaster* genome are similar to humans' genes (Ugar et al. 2016, Vass et al. 2001). As a result, identifying genes influencing immunosenescence in flies may be relevant to understanding the genetic basis of immunosenescence in humans.

A previous study used twelve different genotypes of *Drosophila,* derived from a natural population, to identify the genes that contributed to natural variation in age-specific immune function (Felix et al. 2012). In their study, they infected flies at young and old age and used microarrays to identify genes whose variation in expression following infection was significantly associated with variation in the flies' ability to clear infection. That study identified 205 genes that were significantly associated with variation in immune function at old age. One of these was *Act57B,* which was upregulated or increased sensitivity to the gene in older flies after infection.

Act57B is known to be involved in embryonic muscle development in *D. melanogaster,* and it is one of the few actin genes in the fly that encode myofibrillar actin (Poovathumkadavil & Jagla 2020). However, our study is the first to evaluate the impact of *Act57B* on the immune response. In our study, we independently evaluate the effect of *Act57B* on age-specific immune func-

tion. As this gene encodes an actin motor protein, its role in immunity may be to influence phagocytosis. Phagocytosis is an evolutionarily conserved component of the immune response (Lancaster et al. 2019) which involves the movement of phagocytic cells to sites of infection followed by engulfment and destruction of foreign particles (Uribe-Querol et al. 2020). As the processes of cell movement and engulfment involve actin, we hypothesize that variation in the expression of the *Act57B* gene produces variation in the efficiency of phagocytosis.

To test for the effect of altered expression of the *Act57B* gene on age-specific immune function, we used RNA interference to reduce the expression of this gene in the blood cells of *Drosophila melanogaster*. We maintained normal expression in the control flies across all cell types. We chose to reduce the expression of *Act57B* in blood cells because they are the cells responsible for phagocytosis in flies (Melcarne et al. 2019). We measured the immune responses of one-week and five-week-old flies to measure the effect of this gene at different ages. Flies mature after one week and start showing signs of senescence at four weeks, with immunosenescence being shown at the five-week mark (Campbell et al. 2022).

We looked for the specific impact of *Act57B* on survivorship and age-dependent immune function using the bacterial clearance assay. In this assay, we infected the fruit flies with the bacteria *E. coli*. *E. coli* is not pathogenic to flies, so they survive the infection. Therefore, *E. coli* is a bacteria that can be used to infect flies and monitor the innate immune response exhibited by the flies by examining how well individual flies can clear the infection. We note that the immune response in *Drosophila* has two major components, phagocytosis of bacteria by blood cells and secretion of antimicrobial proteins from blood cells and the fat body of the fly, which kill the bacteria (Hoffmann, J. A. 2003), As such, this assay cannot distinguish the relative contribution of these two components to bacterial clearance. However, given the role of actin in cell movement and cellular reorganization, we hypothesize that *Act57B* is involved in the phagocytic component of the immune response.

We used the Gal4/UAS system (Hales et al. 2015) to reduce the expression of *Act57B* in the flies' blood cells, specifically the hemocytes. This mechanism is activated by performing a genetic cross between two *D. melanogaster* fly lines, a driver line containing the yeast transcription factor GAL4 and a UAS line containing the upstream activating sequence (UAS), a promotor region that the GAL4 binds to. When the females of the driver line are crossed with males from another line containing the UAS, in the offspring, GAL4 binds to the UAS and activates the transcription of genes downstream

from the sequence. The GAL4 line we used, stock number v30140 (Hales et al. 2015), contained a promoter region of the gene, *hemolectin,* upstream of the GAL4 gene. As *hemolectin* is only expressed in hemocytes, the transcription factor that initiates the transcription of *hemolectin* will also initiate the transcription of GAL4 in the blood cells. The GAL4 line was crossed with another line containing the UAS sequence followed by an RNAi against the *Act57B* gene. In the offspring of this cross, the GAL4 transcription factor is expressed in the hemocytes, which then binds to UAS-RNAi against *Act57B*. The RNAi results from the expression of an inverted repeat of a fragment of the *Act57B* gene. Once expressed, this inverted repeat forms a double-stranded RNA hairpin with any *Act57B* mRNA that is expressed (Ni, J. Q. et al. 2008), reducing the expression of *Act57B* in the hemocytes. For the control, we crossed the GAL4 line with a line that had the UAS construct but not the RNAi sequence, stack number v102129. The reason for using the females from the driver line is to maintain the same mitochondrial DNA background for all flies. This gives rise to the control and experimental offspring which have different expressions of the gene, *Act57B,* in their blood cells. In the control flies, this RNAi sequence is absent, allowing regular expression of the gene in blood cells.

Based on the results from Felix et al. (2012), we hypothesize that flies could have a better survivorship and immune response with reduced expression of the gene because *Act57B* was upregulated in older flies while fighting off infections (Felix et al. 2012). It is assumed that the gene has no other effects on other aspects of development because the gene is being reduced in expression in only the hemocytes in the organism.

METHODS

To determine sex, flies were removed from their food vial and placed on a CO_2 emitting pad to render them unconscious. With a light microscope, the flies can be viewed with a high magnification. Males have visible genitalia in the form of a dark spot at the end of their abdomen whereas females usually have a lighter coloration and no male genitalia. The male flies also have sex combs on their first pair of legs that help with identification (Pulver & Berni 2012). Virgin flies were collected to eliminate reproductive effects on the immune response. These flies can be identified by their light coloration and a dark spot which indicates the meconium (Pulver & Berni 2012). The flies are then used for two different assays: the bacterial clearance assay and the survivorship assay.

The bacterial clearance assay assesses the ability of the flies of each sex and genotype (experimental vs. control) to clear an *E. coli* infection at different ages. The flies are separated by sex and stored in vials containing cornmeal, molasses, and yeast food mixture. These flies are aged to five weeks in a humid room set to 24°C and are placed in new food vials weekly. While the flies were aging, the process was repeated to collect the one-week-old flies. The experiment was set up so that the five-week-old and the one-week-old flies were at their respective ages at the same time. This allowed us to infect old and young flies of each sex and genotype on the same day, removing any potential effects of day-to-day variation in the infection procedure and experimental handling.

The method followed is a standard bacterial clearance assay for flies (Felix et al. 2012). Streptomycin (100 mg/ml) was used to prevent unwanted growth in agar plates and the *E. coli* injection solution. *E. coli* was streaked on a plate and grown overnight in a 37°C incubator to allow colonies to form. The injection solution was made by adding one grown colony into Lysogeny Broth (LB solution), made using directions on the product packaging, and was incubated overnight. The optic density (OD) of *E. coli* in the injection solution was measured using a nano spectrophotometer, and the solution was modified with more LB broth to obtain the concentration closest to the required optic density (OD) of 1.00, if necessary. The injection protocol was followed according to the previous paper published by our lab (Campbell et al, 2020). The flies were individually injected with 18.4 nanoliters of the *E. coli* solution that was dyed green with food dye to be visible. If the injection is successful, green food dye can be seen under the fly cuticle. To see the colonies that grow from the infected flies, we used LB agar plates, made according to the instructions on the product packages, and stored in the refrigerator.

The flies were given 24 hours to clear the infection. Subsequently, the flies were separately homogenized in 200 µl of ringer solution and plated on the premade agar plates containing streptomycin. The plates are then incubated for another 24 hours at 37°C (Felix et al. 2012), which is the ideal temperature for *E. coli* to grow. The bacteria remaining in the fly homogenate was allowed to grow into colonies on plates, which were counted using a colony counter machine (Campbell et al. 2022), and the data was recorded. This data was then analyzed using SAS software or R programming language to create ANOVA tables and graphs. This analysis tests our hypothesis that flies with reduced expression of *Act57B* influence the ability to clear infection. Whether the data has a significant difference in the immune response at different ages, gene expression levels, and sexes.

The survivorship assay uses the genetic crossing design above to collect the required flies. For this assay, 250 virgin flies of each sex and genotype (experimental or control) are collected. These flies are then placed separately in cages with food prepared as previously described. Every three days food was replaced in the cages and dead flies were recorded and removed. The data collected was graphed into survivorship curves that represent the individual fly lifespan across all 250 flies for each sex and gene expression. Differences in survival between sexes and genotypes are analyzed statistically using the Cox Regression (Allison 1995).

RESULTS

SURVIVORSHIP ASSAY

The survivorship assay was done to understand if there is a difference in the lifespan of the flies when *Act57B* is knocked down in blood cells compared to the flies with normal expression. The survivorship data collected from females of the control line, with regular gene expression, was graphed with the number of days against the percent of flies alive (Figure 1). The data for the

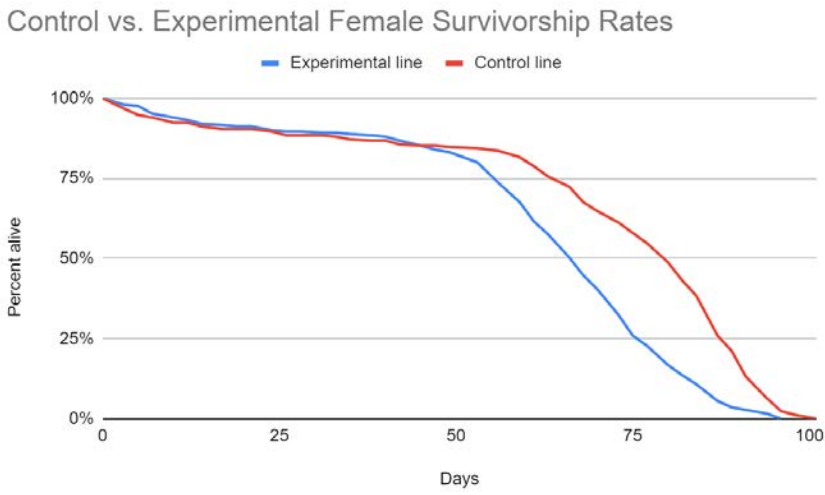

FIGURE 1

First replicate survivorship curve modeling the mortality of virgin female D. melanogaster with normal expression of Act57B (control) and with reduced expression of Act57B (experimental)

males of the control and experimental lines has yet to be collected. The graph indicates that lowered expression of the *Act57B* gene in blood cells causes a 12.5%. reduction in survival rate compared to the controls. However, a second replicate needs to be done to confirm these results.

BACTERIAL CLEARANCE ASSAY

The bacterial clearance assay was done to measure the immune response of the flies when the gene has been knocked down and at normal expression. The data from this assay is the number of colonies grown on the plate of each fly. These values show how effective the flies' immune response is when infected with *E. coli*. A fewer number of colonies indicates a better immune response, and vice versa, with more colonies implying a poor immune response. The data was collected in the form of colonies per milliliter.

The flies were separated by age, genotype, and sex to help manage and graph the data. An analysis of variance (ANOVA) test was done using the SAS programming language and the data was graphed accordingly. The data can be grouped in separate ways: comparing sex to genotype, age to genotype, or age to sex as well as comparing all three components together. In our ANOVA (Table 1) we found significant differences in clearance ability between the genotypes ($F_{1,199} = 11.75$, $p < 0.0001$), ages ($F_{1,199} = 17.11$, $p < 0.001$), and sexes ($F_{1,199} = 4.16$, $p = 0.04$), as well as a significant interaction between genotype and age ($F_{1,199} = 8.82$, $p = 0.003$).

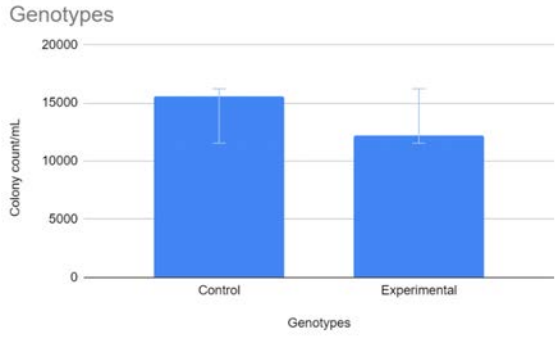

FIGURE 2

Graphical comparison of the average colony count/ mL (±SD) between the two genotypes. This graph groups all ages and sexes for comparison

The clearance ability between genotypes (Figure 2) shows significance because of the approximately 12% (11.89%) difference in the clearance, with

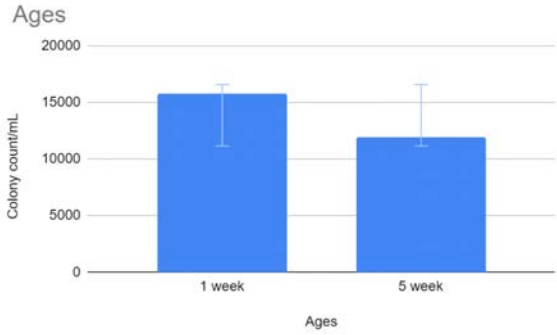

FIGURE 3:

Graphical comparison of average colony count/ mL (±SD) between the two ages. This graph groups all sexes and genotypes for comparison.

the experimental flies of all ages and sexes having an overall improved immune response than the control. Similarly, the clearance ability between the ages (Figure 3) was significant due to the approximately 14% improvement in clearance ability in the five-week-old flies. Additionally, the significance shown in the clearance ability between the sexes (Figure 4) has a 6.5% increase in immune response in the female flies compared to the males. The significant interaction between age and genotype resulted from the fact that

the experimental flies were 29% better at clearing infection at one week of age but not different from controls at five weeks of age (Figure 5).

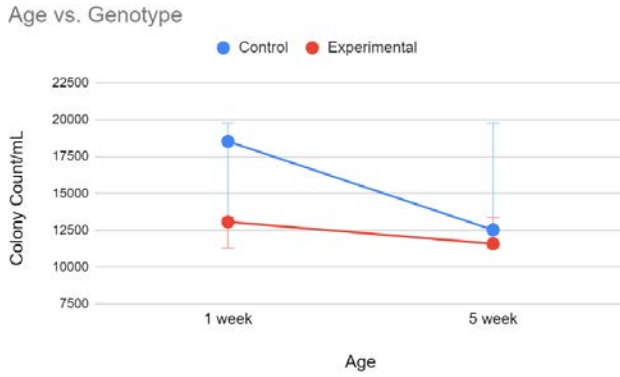

FIGURE 4:
Graphical comparison of average colony count/mL (±SD) between each age and genotype.

Analysis of Variance Table					
Response: CFU.mL					
	Df	sum sq	mean sq	F value	Pr(>F)
Genotype	1	501968870	501968870	11.7484	0.0007399***
Age	1	731008325	731008325	17.109	5.204e-05 ***
Sex	1	177828321	177828321	4.162	0.0426616*
Genotype:Age	1	376903021	376903021	8.8213	0.0033436**
Genotype:Sex	1	77161982	77161982	1.8059	0.1805253
Age:Sex	1	21477271	21477271	0.5027	0.4791601
Genotype:Age:Sex	1	34704817	34704817	0.8123	0.3685443
Residuals	199	8502589689	42726581		

Significance codes: 1	0 '***'	0.001 '**'	0.01 '*'	0.05 '.'	0.1 ' '
[1] 42726581					

FIGURE 5:
Table 1: Result from the ANOVA test

DISCUSSION

We found that the knockdown of *Act57B* in blood cells decreased the life span of females but improved the ability of flies to clear infection. This, along with the better immune response at older age, could indicate that it is possible that targeting the knockdown of this gene in immunotherapy could lead to an improved immune response, albeit with a possible negative effect on life span. While we found significant differences between the sexes—females had improved clearance ability—both sexes responded similarly to the knockdown. As a result, if the deleterious effects on life span could somehow be eliminated, immunotherapy targeted at blood cells could lead to a better understanding of immunotherapies to extend health span.

These results suggest that the gene is responsible for the regulation of innate immunity, but it is not clear if this gene influences phagocytosis or the production of antimicrobial peptides or both. Further research on how *Act57B* influences the immune response are necessary. We did see a trade-off between immunity and life span, however, so when normally expressed the gene may reduce the effectiveness of one immune process to reserve resources necessary for another process that improves lifespan. An alternative explanation is that downregulation of *Act57B* decreases phagocytosis and so hyper-stimulates the production of antimicrobial peptides, perhaps as a stress response even when flies are not infected. Chronic high expression levels of antimicrobial peptides stimulate inflammation which can be detrimental to health, including promoting autoimmune disorders (Biswas et al. 2023). Whether downregulation of *Act57B* causes dysregulation of antimicrobial peptide expression is not known but should be investigated to explain the deleterious effects on life span.

The analysis of the data is hindered due to a lack of replicates for both assays. The survivorship assay still requires data for the males of the experimental and control lines and a second replicate for both males and females for each of the lines. The process of collecting data for the male replicates of the survivorship assay was halted due to damage caused to the lab and equipment during the winter flood of the biology building. For the bacterial clearance assay, a second replicate would be useful to minimize the potential that human error influenced the results. For the current replicate, there was a substantial error in the data due to some of the plates being potentially contaminated by environmental factors. This error can be checked with a replicate of the assay to see if the data is consistent.

We used virgin flies in this experiment, but most flies in nature mate soon after they reach sexual maturity. We used virgins because we wanted

to test the effect of age on immunity without the complicating influences of reproduction. Reproduction negatively affects the immune response of the flies (Short et al. 2012), so if different genotypes also differed in reproductive effort, this could have biased our results. Future experiments should test the influence of *Act57B* knockdown on immunity and life span in mated flies to test this hypothesis.

For the future directions of this project, the plan is to perform a second replicate, as stated above, of the entire experiment including the survivorship assay. We also want to see if there are different genetic effects with the knockdown of the gene. We will understand this by replicating the experimental procedure for a separate genetic line that also has a UAS RNAi construct against *Act57B* but that is inserted in a different location in the genome. In this way, we can ensure that it is the knockdown of *Act57B* that influences our phenotypes and not the insertion of the UAS element itself.

Additionally, the plan is to assess the flies' clearance ability using a different bacterial line, like *E. faecalis*, which is a natural pathogen for *Drosophila melanogaster*. This method may show whether the gene of interest, *Act57B,* is a general immune response gene or if it is more effective against certain species of bacteria. Another part of our future research is to assess the gene's role in specific immune mechanisms of the flies, such as phagocytosis. This experimental process could show whether the gene inhibits the actin processes in phagocytosis.

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04

The Effect of Financial Literacy on Student Loan Behavior

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BIOGRAPHY

Zinedine Partipilo Cornielles (ZP) is a Predoctoral Research Fellow in the Economics Department at Harvard University. He graduated from UMBC earning dual degrees in Financial Economics (BS) and Mathematics (BA). While at UMBC, Zinedine was named Valedictorian for CAHSS, and was also participating actively in the Sondheim Scholars Program, the Honors College, the Sloan Program, and played a pivotal role in the Mock Trial team. With his background as a first-generation Latino immigrant, Zinedine's research focus aligns with development and labor economics, specifically in the Latin American region. Drawing from personal experiences and academic insights, he aspires to delve deeper into these subjects, potentially pursuing a PhD in Economics. His acknowledgments extend to Prof. Tim Gindling, along with the dedicated faculty of the Economics Department, the Sondheim Program, and the Honors College.

RESEARCH JOURNEY

As a first-generation Latino immigrant, my journey to higher education was paved with financial challenges. Ineligible for Federal Student Loans due to my status, the dream of college seemed distant. However, Maryland's policy offering in-state tuition for qualifying immigrants reignited my hope. This personal experience intertwined deeply with a seminar by Prof. Tim Gindling, discussing the economic advantages of in-state tuition for immigrants. This seminar, combined with my background, steered me towards economics, especially labor economics. With the growing student loan crisis, I wondered: could teaching financial literacy in high schools influence student loan decisions? This idea became my research focus. By equipping students with financial knowledge, I believed we could chart a fresh approach to tackle the crisis. Guided by courses in economics, inspirational readings, and mentors like Prof. Gindling, my research journey evolved. It wasn't just about policy solutions; it was personal. By merging my passion with purpose, I aimed to make stories like mine more common, advocating for human capital investments that would benefit countless others.

ABSTRACT

This paper examines the relationship between financial education mandates at the high school level and the frequency of Free Application for Federal Student Aid (FAFSA) applications across the United States from 2011 to 2019. Against a backdrop of declining FAFSA applications, this paper investigates if a state's introduction of financial education mandates significantly influences these rates. Given that the student loan crisis has become more severe in the past few years, this research aims to understand if students with greater financial literacy make better decisions over the mix of different student loans. Federal financial aid is generally a better financial decision than private loans, since federal financial aid charges lower interest rates than private student loans and may provide grants that do not need repayment. This phenomenon makes applying for federal aid a desirable financial decision. Yet, many students who might qualify for federal aid do not take the first step to obtain aid—completing the Federal Application for Federal Student Aid. Completing FAFSA is also a requirement for many subsidized student loans provided by state governments and universities. I propose the hypothesis that students with a higher degree of financial literacy are more likely to make optimal financial decisions, namely, by applying for FAFSA. Through rigorous econometric analysis of data that encompasses detailed information on both financial literacy and student loans, this research examines the potential of increased financial literacy as a partial solution to the student loan crisis. The analysis uncovers a positive and statistically significant correlation between the enactment of financial education mandates and the volume of FAFSA applications, thereby suggesting an instrumental policy avenue to combat the declining trend in FAFSA applications.

INTRODUCTION

The student loan crisis is a concerning problem for current and prospective college students, with more than half of all current college students shouldering some form of student loan (BLS, 2019). The sheer magnitude of this crisis is made visible by the fact that there are 1.5 trillion dollars in outstanding student loan debt, surpassed only by combined mortgage debt in the United States. Student loan default and delinquency rates have risen in the last decade. More people are becoming insolvent with their student loan payments, worsening delinquency rates as demand for some university majors has fallen in the workforce. The student loan crisis is not only problematic in financial terms, but it also affects individuals' livelihoods, educational choices, and future economic stability.

This paper aims to answer the following question: Does the passing of financial literacy mandate at a state level influence student loan applications? Given this evolving and growing crisis, understanding the intersection of financial education and student loan behavior is crucial. Specifically, the paper examines whether the implementation of financial education mandates leads to more FAFSA applications at the state level.

The methodology used is a difference-in-difference regression. This method aims to have a quasi-experimental technique that compares FAFSA applications in West Virginia before and after the introduction of a financial education mandate in 2012. This difference is then compared to FAFSA applications before and after 2012 in neighboring states that did not introduce a financial education mandate. In experimental terms, West Virginia is the treatment group and neighboring states are the control group.

There is an increasing trend across the United States to mandate financial education at the high school level, a policy movement that coincides with a national downturn in FAFSA applications (Dynarski, 2015; Urban et al., 2015). However, there is no research as to the aggregate effects of a policy at the state level, such as mandating financial education courses, on the behavior of decisions regarding student loans. This paper seeks to expand upon the previous literature and tries to establish a causal relationship between the passing of mandates and changes in FAFSA decisions.

This paper contributes the following to the current literature on the topic: First, it provides an analysis of the effect of state-mandated financial education on student loan applications, a relatively unexplored area in the literature. Second, it provides empirical evidence as to how educational changes can affect the financial decision-making process among prospective and current college students. Lastly, it provides a new understanding of the

student loan crisis, considering both future policy implications and possible solutions through the lens of student loan behaviors.

The results of the analysis suggest that implementing a financial education mandate in high school increases FAFSA application rates. The rest of the paper is structured as follows. Section 2 provides a brief literature review and discusses the channels through which more financial education can have an impact on college financial behaviors. Section 3 discusses the empirical methodology and data utilized for the econometric analysis. Section 4 provides the results and discusses its implications. Section 5 concludes the paper.

LITERATURE REVIEW AND HYPOTHESIS

The literature on financial literacy research is changing, as it is a somewhat recent but ever more relevant topic. The main person driving the literature forward is Annamaria Lusardi, who pioneered the three-question test of financial literacy, which other researchers use (Lusardi and Mitchell, 2014). There are different approaches to studying the impact of financial literacy in credit outcomes. Usually, the approaches relate to credit card debt, auto debt, or loan aversion. Despite the magnitude of the student loan crisis, there remains a gap in the understanding of student loan borrowing decisions and repayment strategies.

The concept of financial literacy, as described by Huston (2010), encompasses knowledge about personal financial matters, skills to implement that knowledge, and confidence in one's financial decision-making abilities. In the context of student loans, financial literacy implies an understanding of the terms and conditions of the loans, as well as the long-term financial consequences of these loans.

The evidence of a deficit in financial literacy among college students and the resultant impact on their loan decisions is abundant. For instance, a national study by Lusardi, de Bassa Scheresberg, and Oggero (2016) found that only 24% of young adults demonstrated basic financial literacy, with just 8% showing high financial literacy. Furthermore, students with low levels of financial literacy were more likely to exhibit risky financial behaviors, such as accruing overdraft fees, obtaining access to revolving credit, and carrying large credit card balances (Lusardi et al., 2016).

State-mandated financial education has been suggested as a possible solution to address the student loan crisis (Urban, Schmeiser, Collins, & Brown, 2015). However, the effectiveness of such mandates is not universally agreed upon. This is one of the gaps that this paper aims to fill and thereby provide some evidence towards a clear policy answer.

Other literature has focused on the time it takes to see the effects of financial literacy mandates for high school students in the form of requiring a course on personal finance (or similar) as a graduation requirement. Although some findings suggest that financial education in high school can improve financial outcomes in adulthood, other studies caution that these effects may be small and short-lived (Fernandes et al., 2014). Nonetheless, recent research by Carpena, Cole, Shapiro, and Zia (2021) suggests that the problem may lie in the delivery of financial education rather than its content. They argue that financial education should be "just-in-time"—provided when it is needed, such as immediately before making a student loan decision—and personalized to the learner's situation.

Keeping with this trend, other parts of the literature aim to understand the effects of state-mandate financial literacy courses on the credit behavior of young people (Brown, Collins, Schmeiser, and Urban, 2015). More specifically, the authors aim to capture the impact of state financial literacy mandates on credit scores and delinquency rates. The authors compared the mandates of financial literacy requirements from Georgia, Idaho, and Texas (all introduced in 2007) to other states that did not implement any requirement and compared the difference in the change in outcomes. The authors find that mandates that also implemented course requirements were related to a positive increase on financial literacy test scores.

While an ideal result, it is true that it is hard to measure the effectiveness of the mandates because it is not as simple as better scores on financial literacy tests, which simply show that students do learn from the course. While the literature presents evidence that state mandates of financial education in high school positively affect financial decisions in adulthood (Fernandes, et al, 2014), credit scores, and delinquency rates (Brown, Collins, Schmeisser and Urban, 2015), no study examines the impact of such mandates on student loan behavior. This study fills that gap by explicitly measuring the impact of state financial-education mandates on whether or not students make better student loan decisions. This is important because it has implications for potential ways in which state governments could help address the student loan debt crisis.

From a certain perspective, financial literacy can be seen as either a mean of improving one's human capital or as a tool helping to make better financial decisions, which in turn helps financial wellbeing and might even improve human capital. A lack of financial literacy can be harmful, especially for younger people. A recent college enrollee might be unaware of the multitude of options and costs involved with financing higher education. Financial lit-

eracy can help students make the right choice when deciding how to pay for college.

The current literature suggests that financial literacy is a key element in making appropriate financial decisions, which, in turn, reduce opportunity costs and improve financial wellbeing. Overall, it is not the amount of debt that must change, but the type of debt the student is accruing. If the student is financing their college education through federal loans, as opposed to private loans, then that still is a desirable outcome.

The process of applying for student loans can be quite complex, as well. An indicator that a student is making the right choice in the sense of minimizing costs is if they apply for FAFSA. It can be inferred that a student is not minimizing costs if they fail to fill the FAFSA. Overall, a more financially literate person, or someone who thinks in terms of costs and benefits, should ideally be choosing lower cost loans than high-cost loans, if it is feasible to do so. This can be represented by filling out the FAFSA.

Mandating financial literacy courses in high schools could provide preparatory knowledge for students before they make decisions about financing their post-secondary education. However, a potential policy lag needs to be acknowledged, with the impact of these reforms possibly being discernible only in the long term. First, if the state legislature passes a mandate, it is entirely possible that it does not become implemented in the school system until the following school year. Similarly, there could be a lag in its effectiveness, since students in the school system might be in their second year of high school, and the class could be mandated for those in their last year of high school.

I aim to study if a state passing a financial literacy course requirement for high schoolers has a significant impact on the student loan behavior. I measured student loan behavior as the number of FAFSAs filed per state, over time. This is in contrast to student loan debt, which can also be a measure of behavior. However, that variable will have an inherent upward trend, given the rising costs of college attendance. Similarly, the amount of loans that a student might take out could vary significantly between students and depends on their financial situation. However, there is only one way to obtain federal loans, and it is through filing a FAFSA. This review supports the belief that filing a FAFSA is certainly a better decision than not doing so.

METHODS AND DATA

This paper analyzes state-level trends in FAFSA filing rates across nine school years, from 2011 to 2019. I exclude subsequent years due to potential

exogenous impacts of the COVID-19 pandemic. I begin in 2011, since that is the year for which the first publicly available dataset on aggregate FAFSA applications is available. The data used are longitudinal, with observations from each state for each year between 2011 to 2019. Demographic data from the same time frame was gathered from the American Community Survey (ACS) to ensure consistency. Information about when states implemented financial literacy mandates was obtained from the Council for Economic Education's biennial surveys and supplemented by data from relevant research papers. I gathered data on income brackets, age ranges, demographic and ethnicities, and enrollment percentages. All the data was percentagewise so that it could be compared across states. This data collection process provided sufficient information about the number of students that filed a FAFSA each school year for each of the states used in this study.

From the Council for Economic Education (CEE) Biennial Survey I gathered information regarding the number of states that have some type of high school financial literacy mandate. I had access to the publications of 2020, 2018 and 2016. The data from before those releases comes from the paper "Financial Education and the Debt Behavior of the Young," written by Meta Brown, John Grigsby, Wilbert van der Klaauw, Jaya Wen, and Basit Zafar. An important trend I noticed was that there were few to no changes in the financial literacy mandates across states between 2010 (before the start of the data set) to the year 2019, where only two new states passed legislation in the year 2018. Because of this, there is little variation in the variable associated with having a mandate.

There can also be issues trying to compare all 50 US states across time, especially since states are different in unobservable ways, which would render some issues with the econometric analysis. Furthermore, states do not receive their "treatment" (passing a mandate) at the same time. Yet the technique that compares all 50 states implicitly assumes that the effect is constant across time. However, it is possible that the effect might depend on the specific year the mandate was passed. To address these issues, I will compare one state that passed a mandate with similar states that did not.

The econometric technique I employ in this study is akin to examining the effects of an experiment in a scientific context. Just like in an experiment, control and treatment groups are assigned. In this case, control states are those that have always had a mandate, or never passed one. States which passed a mandate during this time frame are assigned to the treatment group. This technique, known as a difference-in-difference model (DiD), aims to understand how, after a treatment is enacted, we expect to see changes in

the dependent variable, relative to those that remain untreated. What this means, in the context of US states and FAFSA filing rates, is that I am interested in studying how trends in FAFSA filing rates change after a mandate is passed, in comparison to states that did not change their mandate status.

I chose the following states: West Virginia, Virginia, Maryland, Ohio, Kentucky, and Pennsylvania. I did this in order to compare West Virginia, which passed a financial literacy mandate in 2012, to the states of Virginia, Maryland, Ohio, Kentucky, and Pennsylvania. This is because they are geographically all bordering West Virginia. Furthermore, from that group of geographically close states, Virginia and Kentucky had a financial literacy mandate for the full time range while Maryland, Ohio and Pennsylvania did not. Only West Virginia passed its mandate during the time for which I have data, in 2012. The following table summarizes this information.

State	Does it have a mandate?	If so, when did it pass?
Kentucky	Yes	2002
Maryland	No	N/A
New York	Yes	2000
Ohio	No	N/A
Pennsylvania	No	N/A
Virginia	Yes	2009
West Virginia	Yes	2012

TABLE 1:
Timeline of Financial Literacy Mandates

The dependent variable is the number of students who filed a FAFSA each year, across each state, lagged by one year. The policy (and independent) variable is a binary variable that measured if the state had a financial literacy mandate. This treatment is considered as an absorbing treatment, which means that it is equal to zero until the state passes a mandate and continues to be equal to one after the mandate is passed. The rest of the variables are control variables, such as time and state dummies, as well as demographic ones (like income, education, age ranges, race).

I began by conducting a panel regression of the natural logarithm of the number of FAFSAs filed on the financial literacy mandate variable and a set of control variables, as well as state and time dummy variables. Given that

states passing a mandate can be considered "treated" and those not passing one remain "untreated," the DiD model was applicable in this case. The regression line for the DiD model is as follows:

$$y_{it} = \alpha + \beta_0 * \Phi_{it} + \beta_1 + \chi_{i_t} * \psi_i + \Delta_t + \varepsilon_{it}$$

Where y is the outcome of interest (the log of the number of FAFSA applications), ϕ equals one if the state has a financial literacy mandate, and zero if they have not. X is a vector of control variables, which control for demographic characteristics, income, and age brackets, as well as people currently enrolled in undergraduate. The subscript i indicates a specific state, while t indicates the time period. α is the intercept in the model, ε measures the error term, and and are the state and time dummies, respectively. State fixed effects control for anything that differs between states that does not change over time (such as culture). Time fixed effects control for anything that changes over time that affects all states equally (such as a recession). The main coefficient of interest is ϕ, which measures the effects of a mandate in FAFSA applications rate.

RESULTS

A counterintuitive finding was that, over time, the trend for application rates for FAFSA has been negative. Graphs plotting this trend can be found in the Appendix. This finding is obviously concerning, given that student debt continues to increase over time. If FAFSA application rates are decreasing, then it likely means that students who are attending college are financing college through private loans. It is worth noting that most of the states included in this data have a downward trend in the number of students enrolled in undergraduate studies. The results from the regression estimates are found in the table below, and they are proceeded by discussion and interpretation.

VARIABLES	Log of total FAFSA Filings	
State has a mandate	0.129*	(0.052)
Population: Proportion of White	4.179	(3.323)
Population: Proportion of African American	-6.994*	(3.879)
Population: Proportion of Hispanic	6.169	(5.927)
Population: Number of Native Citizens	0.683	(1.227)
Population: Number of Naturalized Citizens	2.211	(2.986)
Age: Proportion of People aged 5-15	11.734**	(5.326)
Age: Proportion of People aged 15-19	2.245	(4.721)
Age: Proportion of People aged 20-24	-1.645	(4.609)
Income Bracket: Less than $10k	0.074	(2.409)
Income Bracket: $10k to $15k	5.070	(3.344)
Income Bracket: $15k to $25k	1.611	(1.656)
Income Bracket: $25k to $35k	1.883	(1.637)
Income Bracket: $35k to $50k	0.107	(1.619)
Income Bracket: $50k to $75k	-3.100	(2.107)
Log Enrolled Undergraduate Students	-0.228**	(0.109)
Post Indicator	-0.004	(0.017)
Constant	8.512**	(3.428)
Observations	54	
Number of state	6	
R-squared	0.956	

TABLE 2:
Regression Results - West Virginia vs Neighboring States: Difference-in-Difference Model

NOTE:
*State and Year Fixed Effects are Included in the regression. *** p<0.01, ** p<0.05, **

The DiD model shows consistency with the hypothesis that states do benefit from passing a financial literacy mandate. The interpretation of the coefficient in the policy variable is that, when West Virginia passed its financial literacy mandate, the expected increase in FAFSA filings is about a 12% increase in applications.[1] This result is significant at the 5% significance level. What this means is that relative to states that did not pass a mandate during

1 This result comes from exponentiating the coefficient and then subtracting one, since we have a log-linear model.

this time, West Virginia expects to see an increase in FAFSA filings. On average, application rates would be 12% higher than those states who did not pass a mandate. One of the advantages of utilizing a logarithmic transformation of the dependent variable is that the interpretation remains in percentages, which are easier to understand.

To verify the robustness of these results, I conducted sensitivity analysis. I re-ran the regressions and compared West Virginia to the states that never passed a mandate, and separately to the states that had a mandate for the whole time range. Sensitivity analysis revealed that the coefficient was still significant when comparing West Virginia to "untreated" states. For further details regarding sensitivity analysis, the Appendix contains different regression specifications to test for the robustness of the results.[2]

CONCLUSION

This research article studies the influence of financial literacy mandates at the state level on FAFSA filing rates. More specifically, I study how FAFSA filing rates improve for West Virginia relative to similar neighboring states. My analysis suggests there is a positive relationship between the passing of a mandate and an increase in federal loan application rates. I find, using a difference in difference model, that the impact is positive and significant, leading to a 12% increase in filing rates.

While the results suggest that mandates have a positive impact, these results are not without concerns. Primarily, I use a small sample of observations. I only study six states over nine time periods. Secondly, I lack data prior to 2011. Furthermore, there is very little variation in policy mandates over time, which, in turn, leads to small variation in the key policy variable. Finally, these findings do not say anything about students choosing federal loans over private loans, which is something that future research endeavors should aim to study. Future research could study this by employing a larger or different data set.

The policy implications of this study are relevant with respect to the ongoing student loan crisis in the United States. This paper suggests that state-level financial literacy mandates in public education positively influence students' loan decisions, increasing the aggregate filing rate of federal student loan applications. This suggests that increases in financial education could

2 In the appendix, I run the regression without controls, with only state fixed effects, with added controls, state fixed effects and a time trend, as well as a post-treatment indicator and find results that are consistent.

play a critical role in addressing the student debt crisis through the channels of enhanced financial awareness and decision-making among potential college students. However, it is important to balance these benefits against the implementation costs and consider the political and practical feasibility of such mandates.

Future research should aim to address the gaps identified in this study. Moreover, a comprehensive understanding of student financial behavior would be ideal, as I only study aggregate level changes in loan behavior, and not at the individual level.

In conclusion, this paper suggests there is a potential role for financial literacy education as a policy tool in addressing and facing the challenges of the student loan crisis. However, these results are preliminary and use observational, state-level data as opposed to experimental data at the individual level. There remain many complexities surrounding student financial behavior and ways of tackling the student loan crisis.

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APPENDIX

	Log of total FAFSA Applications	Population: Proportion of White	Population: Proportion of African American	Population: Proportion of Hispanic	Population: Number of Native Citizens	Population: Number of Naturalized Citizens	Age: Proportion of People aged 5-15	Age: Proportion of People aged 15-19
Kentucky	12.502	.874	0.081	.022	.96	.015	.19	.067
Maryland	12.822	.573	0.293	.064	.863	.069	.186	.065
Ohio	13.458	.819	0.124	.026	.958	.021	.186	.067
Pennsylvania	13.429	.816	0.101	.049	.93	.035	.173	.066
Virginia	13.09	.681	0.188	.062	.888	.058	.186	.067
West Virginia	11.485	.941	0.033	.009	.972	.014	.17	.062

TABLE 3:
Descriptive Statistics Table

Age: Proportion of People aged 20-24	Income Bracket: Less than $10k	Income Bracket: $10k – $15k	Income Bracket: $15k – $25k	Income Bracket: $25k – $35k	Income Bracket: $35k – $50k	Income Bracket: $50k – $75k	Median Income	Log Enrolled Undergraduate Students
.068	.095	.065	.122	.111	.144	.178	45779.222	4.892
.066	.051	.032	.066	.069	.104	.167	77014.222	5.471
.067	.077	.054	.11	.106	.14	.186	51350	5.954
.066	.068	.05	.103	.098	.132	.182	55874.556	5.991
.07	.056	.039	.08	.081	.118	.172	67348.333	5.809
.064	.099	.068	.138	.117	.147	.176	42534.444	6.096

	Log of total FAFSA Applications						
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
State has a mandate	-0.117*	0.000331	0.0550	0.152***	0.190***	0.129**	0.179***
	(0.066)	(0.0381)	(0.0391)	(0.0514)	(0.0522)	(0.0520)	(0.0645)
Population: Proportion of White			-3.114	-0.389	-2.809	4.179	3.005
			(2.835)	(2.855)	(2.552)	(3.323)	(3.408)
Population: Proportion of African American			-6.559	-4.160	-9.719**	-6.994*	-7.514*
			(3.904)	(3.782)	(3.599)	(3.879)	(3.857)
Population: Proportion of Hispanic			0.538	0.840	-2.944	6.169	4.017
			(6.059)	(5.758)	(5.353)	(5.927)	(6.090)
Population: Number of Native Citizens				1.701	2.482**	0.683	1.131
				(1.282)	(1.175)	(1.227)	(1.262)
Population: Number of Naturalized Citizens				5.389*	7.255**	2.211	3.586
				(3.074)	(2.825)	(2.986)	(3.136)
Age: Proportion of People aged 5-15					9.937*	11.73**	7.185
					(5.239)	(5.326)	(6.320)
Age: Proportion of People aged 15-19					5.786	2.245	2.301
					(4.483)	(4.721)	(4.669)
Age: Proportion of People aged 20-24					-9.634**	-1.645	-6.289
					(4.648)	(4.609)	(5.787)
Income Bracket: Less than $10k						0.0737	-0.588
						(2.409)	(2.436)
Income Bracket: $10k to $15k						5.070	4.244
						(3.344)	(3.367)
Income Bracket: $15k to $25k						1.611	1.351
						(1.656)	(1.649)
Income Bracket: $25k to $35k						1.883	1.750
						(1.637)	(1.622)
Income Bracket: $35k to $50k						0.107	-1.143
						(1.619)	(1.866)
Income Bracket: $50k to $75k						-3.100	-2.803
						(2.107)	(2.097)

Log Enrolled Undergraduate Students	0.897***	-0.0261	-0.115	-0.137	-0.251**	-0.228**	-0.268**
	(0.114)	(0.109)	(0.107)	(0.102)	(0.0998)	(0.109)	(0.113)
Years		-0.0332***	-0.0397***	-0.0380***	-0.0382***		-0.0190
		(0.00322)	(0.00619)	(0.00589)	(0.0101)		(0.0146)
Post Indicator			-0.0168	-0.0279*	-0.00945	-0.00429	0.00248
			(0.0156)	(0.0155)	(0.0143)	(0.0172)	(0.0178)
Constant	7.738***	13.11***	16.95***	12.79***	13.87***	8.512**	10.79***
	(0.651)	(0.633)	(2.960)	(3.420)	(3.424)	(3.428)	(3.816)
Observations	54	54	54	54	54	54	54
R-squared	0.594	0.879	0.905	0.920	0.945	0.956	0.958
Number of states	6	6	6	6	6	6	6
State FE	X	X	X	X	X	X	X
Post FE			X	X	X	X	X

TABLE 4:
Sensitivity Analysis for the Regression Specification

05

Bitch Syndrome: Investigating How Masking, Late Diagnosis, and the Patriarchy Impact Autistic Women's Social Experiences

Darcie Adams

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DEPARTMENT OF
GENDER, WOMEN'S, +
SEXUALITY STUDIES

BIOGRAPHY

Darcie Adams graduated from UMBC in May 2023 with double BAs in Gender, Women's + Sexuality Studies and Political Science with a minor in Russian. He has remained at UMBC and has begun working toward a Masters in Community Leadership. As a disabled trans activist and scholar, he plans to begin a career in higher education with a focus on disability culture. He is dedicated to changing the ways we talk about disability, educating our students, staff, and faculty about disability, and creating environments in universities where disabled voices are not just equal but celebrated and uplifted. Darcie wishes to thank Dr. Drew Holladay for his excellent mentorship over this year-long process and for never once doubting that this work would be completed and valued; Dr. Kate Drabinski for not just showing him the path every time he needed one, but giving him a gentle shove to start walking; and Dr. Mejdulene Shomali for being enthusiastic when the first draft of this paper was 44 pages.

RESEARCH JOURNEY

I came to this research from the perspective of wanting to understand my own life experiences and wanting to position those experiences within the larger academic contexts I had spent so much time learning about. As a formerly female-identified person (I now identify as male) who came to their autism diagnosis late in life, I did not see myself reflected in the published research on autism in women. The intersection of disability and feminism is very important to me, and while scholars have been looking through that lens for a few decades, I didn't see it extending to the research being done on autism. If we are to learn about ourselves and to examine the ways in which society stigmatizes women, disabled women, and disabled autistic women, we have to focus our research within the lived experience and not as separate facets of life. I decided to embark on this research journey because I wanted to start filling the gap in the literature that I saw, and it's my hope that anyone else who doesn't see themselves represented in academia will choose to do the same.

ABSTRACT

This study proposes a new term "bitch syndrome," intended to encapsulate the experiences autistic women face at the intersection of disability and the patriarchy: the double stigmatization of failing to be feminine enough while also failing to adhere to allistic social standards. Being labeled as "bitchy" by their peers leads these women to produce and sustain allistic "masks" more successfully and for longer periods than male autists, which reinforces gendered behavioral expectations. This study is a mixed-method phenomenological approach that examines first-person narratives from autistic women using TikToks, Tweets, and other written narratives. This study quantitatively identifies the words most commonly used negatively towards autistic women, and then seeks to qualitatively understand how identified themes permeate these interactions to reproduce stigma against autism and disability, patriarchal gender norms, and a culture of closeted silence for autistic women. This study contributes to a growing body of research into why autistic women are underdiagnosed. Importantly, this study is on a research topic of great importance to the autistic community itself, and participates in the fast-growing movement for autism research to be done by autistic people.

INTRODUCTION

Research on autism and autistic people is typically done in one of two veins: to either "cure" it or to "examine" it. Much of the body of research currently available on autism has been done on autistic individuals by non-autistic researchers who sought to understand autism through a clinical lens. This body of work revolves around the idea that autistic individuals must "be normalized" in order to assimilate into society and thus be happy (Milton and Lyle, 2012). Even in circumstances where a non-autistic researcher is genuinely seeking to understand an autistic experience, they often struggle to do so. Damian Milton calls this process the "Double Empathy Problem" in which the non-autistic researcher and the autistic participant have different conceptualizations of their interactions (Milton, 2012). While the autistic participant is aware of this disconnect, the non-autistic researcher is not; thus their description and analysis of the research is not an authentic portrayal or understanding of the autistic participant's experiences.

Published descriptions of autism (such as medical, psychiatric, or other scientific descriptions) are derived from and become codifications of assumed normative social dynamics where autistic behavior is "measured" by an observer according to its distance from the norm. To correct this, we must have research conducted with and by autistic individuals seeking to understand and analyze autistic experiences. Autism is a form of embodiment that is heavily stigmatized even within the disability community that has resulted in a massive social power imbalance that disfavors autistic experiences and has contributed to the minoritization, discrimination, and oppression of the autistic population (Brown, 2013). This study seeks to contribute to the small body of academic research that focuses on normalizing and destigmatizing autistic existence by examining autistic lived and embodied experiences. It also seeks to contribute to the ongoing effort within the autistic community to promote our own voices, experiences, and research.

My research questions ask: What negative social interactions do autistic women face and how do those interactions contribute to the wider trend of late diagnosis for autistic women? How do the patriarchy and disability stigma influence and/or change the outcomes of these interactions? Within the academic body of research on embodied autistic experience, limited scholarship is available that discusses specific negative-coded interactional phenomenon at this level of specificity. This study is positioned in this gap and argues that the late diagnosis and phenomena of high-masking of autistic women are set in motion by the expectations of the patriarchy and reinforced by ongoing disability and autistic stigma. While my proposed topic may be original

to academic research, it is not at all original to the autistic community; rather, it is a topic frequently discussed and examined as frustrating and confusing. I seek to undergo this research for the benefit of the autistic community and to contribute to a better understanding of our own embodied existences.

The application of this research is to contribute to the continued effort to destigmatize autism and to contribute to not just autism awareness, but autistic acceptance. This research also contributes to the ultimate goal of normalizing autistic representation not only in research but as researchers. Futhermore, it contributes to a purposeful exploration of the autistic lived and embodied experience, reframing it not as abnormal but, simply, as different. This perspective underscores the importance of studying, examining, and engaging in academic research on autism with the same level of significance as non-autistic lived and embodied experiences.

POSITIONALITY

Darcie self-diagnosed as autistic, was raised as female, and came to the late realization that he is a transgender man somewhere in between researching and writing this paper, which makes him both late-diagnosed autistic and late to get out of the closet. He, like many autists before him, developed a special interest around his own disabilities, and can tell you many fun facts about autism, ADHD, Ehlers-Danlos Syndrome, and the various co-morbidities that come with a genetic disorder.

LIMITATIONS AND FURTHER RESEARCH

This research is limited by the constraints of a media analysis, and further research would benefit from interviews with late-diagnosed autistic women. Only so much of their history, lives, and intersectional identities can be known or understood through the media they choose to publish online, and interviews would allow for a much wider breadth of understanding. It would also be essential to be intentional in addressing how late diagnosis impacts women of color, particularly Black women, and how the high percentage of people who ultimately do not end up identifying with the gender they were assigned at birth impacts or clouds late diagnosis. The patriarchy interacts with women of color and transgender folk differently, but no less strongly.

LITERATURE REVIEW

THE BASICS OF AUTISM

According to the Diagnostic and Statistical Manual (DSM), in order to receive a diagnosis of Autism Spectrum Disorder (ASD) an individual must have "persistent deficits in social communication and social interaction across multiple contexts, plus restricted and repetitive patterns of behavior, interests or activities" (5th ed.; DSM–5; American Psychiatric Association, 2013). Both diagnostic categories have sub-criteria that describe specific deficits; an individual must exhibit at least three deficits in social communication and at least two types of restricted, repetitive behaviors. The DSM's criteria are intended explicitly for children, and there are no gender-related criteria. The diagnostic criteria put forward by the DSM are steeped in the pathology paradigm which assumes that there is a "normal" and an "abnormal" way for bodies and minds to exist in the world and that the modern medical and scientific establishment sets the definition and baseline of normal (Walker, 2021). An alternative definition posed by Dr. Nick Walker states that "autism is a developmental phenomenon, meaning that it begins in utero and has a pervasive influence on multiple levels of development throughout the lifespan. Autism produces distinctive, atypical ways of thinking, moving, interaction, and sensory and cognitive processing. One analogy that has often been made is that autistic individuals have a different neurological 'operating system' than non-autistic individuals" (Walker, 2021). This definition highlights the functional differences autistic people face but avoids negative labeling or framing differences as a problem. While autism is not a new diagnosis, only in the last few decades has it been widely accepted that it is primarily a genetic developmental condition rather than one that is caused by environmental factors such as poor parenting (Thapar and Rutter, 2020).

Estimates of how much of the population meets the criteria for a diagnosis has risen to 1% (Baird et al, 2006), with data from 2018 showing 1 in 44 children born in 2010 meeting diagnostic criteria (CDC). The rise in diagnosis rates is thought to be due to a broadening of the diagnostic criteria and advancements in diagnostic capabilities of the medical and psychiatric establishments (La Roche, et al, 2018; Thapar and Rutter, 2020). ASD is currently thought to be four times more common in boys than girls (CDC, Jones 2016, La Roche, et al, 2018).

THE AUTISM TREATMENT PROBLEM

Autism is very commonly comorbid with a wide variety of other disorders, ranging from intellectual disability, ADHD, epilepsy, Obsessive Compulsive Disorder, Tourette Syndrome, and schizophrenia (Thapar and Rutter, 2020). Emerging research suggests a strong overlap between autism, gender dysphoria, and connective tissue disorders such as Marfan Syndrome and Ehlers-Danlos Syndrome (Casanova, et al, 2020; Kallitsounaki and Williams, 2022). Getting several overlapping disorders diagnosed correctly and in a timely manner is a challenge; no cure or medication-based treatment exists for autism and, historically, the recommended treatment has been entirely behavioral. This behavioral treatment, Applied Behavioral Analysis (ABA), is currently the only treatment approved for autism that will be covered by health insurance in the United States (Broderick and Roscigno, 2021). The premise is simple enough: the behavioral technician positively reinforces behaviors they want to encourage and negatively reinforces those they do not want to encourage. Problematic autistic behaviors that are frequent targets for negative reinforcement under ABA typically include lack of eye contact, "stimming" (repetitive body movement), lack of verbal response or acknowledgement, and inappropriate play with toys (Milton and Lyle, 2012). ABA is performed almost exclusively on children. ABA is predicated upon the "normal" and "abnormal" dichotomy and can be brutal in its application. Practitioners are trained to ignore children or place them in "time out" that rivals solitary confinement in prison, prohibit the child to engage with their special interest, to yell "no" at a child, to slap a child's thigh, to give electric shocks, and/or to forcibly hold a child's body down to prevent stimming behavior (Milton and Lyle, 2012; Gibson and Douglas, 2018). In investigating ABA's founder, Ole Ivar Lovaas, Gibson and Douglas find that the ABA treatment method actually originates in the same treatment model as gay conversion therapy, which Lovaas helped develop in the 1970s through the Feminine Boy Project.

The first generation of autistic children who were treated with ABA have now become adults and have spoken out against ABA, denouncing it as an unnecessary, traumatizing practice (The Autistic Self-Advocacy Network, 2012). Researchers who are suspicious of the practice and the claim that it is evidence-based have been unable to demonstrate any clear difference in long-term outcomes between those who had ABA and those who did not: using measures of "intelligence, language use, daily living skills, and a statistical measure of 'best outcomes', the majority made no significant advances" (Milton and Lyle, 2012). ABA is not a treatment that seeks to help autistic

children understand the source of their own behavior or how to understand societal expectations, but is instead based in what is called Behaviorism, or correcting a child's pathologized behavior until they behave in a manner that is indistinguishable from their allistic (non-autistic) peers, regardless of the origin or cause of the behavior (Milton and Lyle, 2012; Gibson and Douglas, 2018). Under ABA, an autistic person is "framed as being incapable of self-surveillance, a potentially dangerous individual lacking in empathy, and in need of external and potentially coercive techniques in order to manage and control their 'challenging behavior.' […] The autistic person is thus constructed within this discourse as having no agency and simply the subject to be worked upon, to be socialized as best one can, so that one can 'pass as normal'" (Milton and Lyle, 2012). This stigmatization perpetuates the cycle of ABA: autistic children, in pursuit of social acceptance and parental approval, conform to desired behaviors, suppressing their way of being. Consequently, they unintentionally contribute to the narrative popularized by ABA, suggesting their perceived incapability and "reinforce a cultural hierarchy which values non-autistic behavior over autistic behavior" (Libsack, et al, 2021).

AUTISM AND SOCIAL INTERACTION

Autistic people are often framed within psychology as lacking "theory of mind," which is the idea that they fail to understand that other people have a mind or that they themselves have a mind. This idea was developed by Simon Baron-Cohen and is based in studies that fail to consistently demonstrate this claim. Despite Baron-Cohen more recently acknowledging that a lack of theory of mind may not be specific to autistic people, the principle is now entrenched in psychology literature and practice (Gernsbacher and Yergeau, 2019) and has contributed immensely to the stigmatization of autism. Lack of theory of mind is typically associated with a lack of empathy, an inability to understand the mental states and motives of other people.

It is assumed that allistic or neurotypical people have empathy as a standard baseline and apply that empathy accurately and successfully. These assumptions are the assumptions of the allistic person, however, and fall apart once the autistic person's experience is taken into consideration. Damien Milton has termed this the "double empathy problem" wherein allistic people are often unable to apply empathy accurately to autistic people, and autistic people view these empathy attempts as invasive, imposing, and threatening, especially when their protestations are ignored by the allistic person. The social interaction between an allistic and an autistic person is equally disjointed due to the fact that both parties are unable to process the other's attempt to

communicate meaning. This disjuncture, however, is more severe for the autistic person (Milton, 2012). As Milton states, it's true that autistic people often lack insight into allistic perceptions and culture, but it is equally true that allistic people lack insight into the minds and culture of autistic people. Lack of theory of mind and lack of empathy are both predicated in allistic points-of-view of autistic ways of being and fall prey to the double empathy problem.

MASKING? CAMOFLAGING? PASSING AS NON-AUTISTIC?

A frequent behavior found in autistic people is known commonly as "masking" in the United States, "camoflaging" in the United Kingdom, and has recently been consolidated into a less-stigmatizing term called PAN, or "passing as non-autistic," which is the term that will be used here (Libsack, et al, 2021). PAN involves a series of coping strategies or survival mechanisms for social situations, which can range from suppressing stimming, increasing or forcing eye contact, positioning themselves into pre-defined social roles, preparing topics and practicing conversations (known as "scripting") to follow, and mimicking the behavior of those around them (Hull, et al, 2017; Libsack, et al, 2021). PAN strategies are typically developed as a response to stigmatization and can lessen or eliminate stress and social anxiety and allow people to "pass" as allistic (Libsack, et al, 2021). PAN strategies are commonly developed in adolescence, when autistic children start to be overwhelmed by their social environment and begin to have a strong desire to make friends; PAN is typically continued into adulthood to maintain relationships, employment, and independence (Hull, et al, 2017; Libsack, et al, 2021). PAN is also associated with poor mental health and may contribute to the difficulty and delay of ASD diagnosis for some people. In particular, PAN is hypothesized as an explanation for the missed or late diagnosis of autistic women; while men and women experience the same autistic symptoms at similar rates, women frequently experience "internalizing" of their autistic symptoms that makes those symptoms easier to miss or dismiss and have strong gendered social expectation to conform to (Hull, et al, 2017; Libsack, et al, 2021).

METHODOLOGIES

This study is based entirely on publicly available media and follows Interpretative Phenomenological Analysis (IPA) guidelines and the importance of direct autistic participation in research about autism and/or research being done on autistic people. This is reflected in this study through the following

assumptions: that autistic people are experts in their own lives, that there will always be an understanding gap between how the autistic person describes their experience and how the researcher then tries to understand that account, and that data collected here will not be viewed with strict objectivity but will instead be understood and contextualized into the larger body of knowledge (Howard, et al, 2019; Fletcher-Watson, et al, 2019). Additionally important to this study is to utilize a broader phenomenological perspective that reminds us that our embodied experiences are a product of historical situation and subjective experience (Butler, 1988).

This study is firmly entrenched in feminist theory and seeks to contextualize autistic women's experiences into the larger body of feminist work. Gender as a performance (Butler, 1988) and the existence of multiple genders (Butler, 1990) are understood in this study as implicitly true; gender as a hegemonic socialized construct (Connell and Messerschmidt, 2005) is important to understanding how this author will deconstruct passing as non-autistic. This study will specifically seek to understand autistic women's experiences as intersectional (Crenshaw, 1989) situated standpoints (Haraway, 1988; Hartsock, 2020) that are impacted by the patriarchy and hierarchal power dynamics (Bartky, 1997; Collins, 1990).

Critical disability theory is also crucially important to this work. This study treats the Social Model of Disability as the preferred framework and actively seeks to tear down the medical model of disability and pathologizing frameworks. It is important to acknowledge that both ability and disability are not clear-cut, easy-to-define terms with explicit meanings, and that disability is a construct of neoliberal capitalism and is defined by modern societies as an inability to work (Puar, 2013). While the impact of capitalism and the medical model of disability on the autistic experience cannot be ignored, this work seeks to acknowledge them through Tobin Sieber's lens of complex embodiment: the disabling environment is a very real phenomenon, but so are chronic pain, secondary health problems, and aging that contribute to disability (Siebers, 2013).

This study uses mixed methods and has both quantitative and qualitative data and analysis. Sources used for this work are multi-media, featuring the following: 12 passages from one memoir, "Nanette" by Hannah Gadsby, five short essays from the anthology "Loud Hands: Autistic People Speaking", 19 TikToks, and 23 Tweets. TikToks were manually transcribed by the author. The TikToks and Tweets were sourced by searching for conversational threads discussing autism and "being intimidating" and similar conversations that discussed commentary or feedback autistic people had been given. It is

important to note that all sources for this study come from people speaking from an autistic experience. This study does not differentiate between formal autism diagnosis and self-diagnosis, as self-diagnosis is important to the autistic community and has been shown to be accurate (Sizoo, et al, 2015).

This study seeks to understand the social experiences of late-diagnosed autistic women, and the quantitative analysis seeks to break down the way they describe their social interactions for themselves and their understanding of those interactions via word choice. This was done by examining each source and coding words and phrases into the following three categories: 1) "Words Autistic Women Use to Describe Themselves", 2) "Words Used to Describe Autistic Women" or commentary from someone else about the autistic person, or 3) "Insults," which were intentionally coded separately from "used to describe autistic women" (despite being commentary from someone else about the autistic person). The two main categories were then coded into one of six emotion categories that are based on Abby Vanmuijen's emotion wheel: anger, disgust, fear, genius, joy, and sad. Coding into emotion categories was done based in the context the word was used and not necessarily its base meaning to best capture the intent of the word usage.

The intent of the qualitative analysis was to develop narrative themes based around the lived experiences described by the autistic women in the sourced media samples. The following three themes were developed: 1) Faking It and Not Making it, 2) Bitch Syndrome, and 3) The Abandonment of Autistic Women. These themes ultimately describe and analyze a loosely chronological account of the shared experience of many late-diagnosed autistic women and seek to then contextualize that experience through feminist and disability theories. "Faking It and Not Making It" examines childhood and adolescence, how the patriarchy intersects with disability and autistic stigma and how many autistic girls go undiagnosed. "Bitch Syndrome" describes their teenage years and young adulthood and how the patriarchy's expectation of their performance of femininity sets young autistic women up for social failure. "The Abandonment of Autistic Women" looks at adult women and how decades of undiagnosed disability, repetitive and layered stigma, and the inability to live up to societal pressure can and do produce severe and long-lasting consequences.

QUANTITATIVE RESULTS

The quantitative analysis was undertaken first to understand the emotional "temperature" of the experiences described by the autistic women of the studied sample. Abby Vanmuijen's emotion wheel was chosen for its

specificity and ability to apply it to emotions depicted that are not one's own; it is also more relatable to an autistic lived experience using "joy" and "genius," in particular, which are more accurate reflections of the way autistic people perceive their existence than categories such as "happiness" would be. Only words that appeared at least twice across any of the examined texts are recorded here, except for the insult category, which intentionally displays words and phrases used once as an example of the type of microaggressions autistic women face.

The majority of the examined narratives involved autistic women recounting conversations or situations in which they participated. They conveyed either direct statements made by their conversational partners or summarized a series of similar comments received over a period. Unfortunately, the vast majority of "Words Used to Describe Autistic Women" were categorized into anger, disgust or fear which in the context they were used in, were negatively-coded; there were a small selection of words coded to the other categories but were only used once, and were ultimately omitted from the study as the goal of this work is to understand trends and narratives. In contrast, "Words Autistic Women Use to Describe Themselves" trends across all 6 possible emotional categories, despite the smaller sample size of women describing themselves in the examined texts.

Words Used to Describe Autistic Women					
Anger	**#**	**Disgust**	**#**	**Fear**	**#**
Rude	6	Direct	8	Intimidating	21
Mean	5	Blunt, flat	4	Scary	4
Aggressive, hate	4	Awkward	3	Intense	3
Nasty	3	Bossy, dislike, judging, monotone, mysterious, tone	2	Silent	2
				Harsh, Upset	2
Insults					
Bitch	6				
Acquired taste, debbie downer, sociopath, feisty, too much, two-faced	1				

QUANTITATIVE RESULTS

Words Autistic Women Use to Describe Themselves					
Anger	#	**Disgust**	#	**Fear**	#
Frustration	2	Awkward	3	Confusing	4
		Strange Social Dance	2	Anxiety, masking	3
				Tense, bad	2
Genius	#	**Joy**	#	**Sad**	#
Logical, self-aware	2	Kind, natural, nice	2	Stressed, exhaustion, unmask	2

QUALITATIVE ANALYSIS

FAKING IT AND NOT MAKING IT

Autistic girls are quickly taught by their peers that they are different and that their difference is unwelcome; that said, there is a patriarchal expectation that little girls are social butterflies and that if they aren't making friends, they just need to keep trying. Regardless of their actual success at making and maintaining friendships, autistic girls are shown to be much more social than autistic boys, and this can be attributed to gender socialization; gender stereotypes require women to be friendly, conversational, and likable (Seers and Hogg, 2021; Beck, et al, 2020; Belcher, et al, 2022). Allistic children in Elliemidd's classes ostracized her for not following the social rules they had already learned and internalized at a young age, leaving her confused, upset, and disappointed: "[I] quickly realized more than I ever had before that I was just not like other girls my age. They kind of had these social rules I didn't seem to understand, there were these friendship groups I didn't really like and felt quite claustrophobic to me, there was kind of like 'she's my best friend so she can't be your friend', and I just could not comprehend these rules in anyway" (Tiktok user elliemidds). Elliemidd, like many autistic girls, did her best to fit in any way and to mimic the way their peers interact with one another, but despite her best efforts, it didn't quite work out, and she remained socially isolated. As these autistic girls age into teenagers there is greater and greater pressure for them to conform to expectations of femininity, which includes a much higher expectation of socializing for girls than it does for boys (Belcher, et al, 2022). Some girls feel as if they are missing a rulebook for social interactions that was given to their peers, as hannahbaked describes: "every other neurotypical person - they attended some class when they were little that taught them exactly how to socialize and exactly how to

be friends with neurotypical people - that I don't have, it's like they're reading from a play" (Tiktok user hannahbaked). This idea of a "missing rulebook" is very common for autistic folk of any gender, but especially for girls, who tend to find that the expectations young girls assign to each other overwhelming. While research shows that trying to pass as non-autistic is not a phenomenon exclusive to women, many of the women in the examined narratives described needing to mask to gain any semblance of social acceptance. Autistic women report higher levels of masking and trying to pass as non-autistic (Schuck, et al, 2019; Belcher, et al, 2022) and their compensation strategies involve "emulat[ing] patterns of social behavior and craft[ing] a persona that is gauged to have a high chance of social success" (McQuaid, et al, 2022). Efforts to pass as non-autistic vary, but typically include suppressing their desire to discuss their special interests, forcing themselves to make eye contact, and modulating their body language:

> [...] if you're late diagnosed and high-masking you end up cultivating a mask that is the one that you think your friends want or like and you will notice throughout your entire friendship there are times where your true autistic self comes out and it's usually met with the look. [...] Every time you meet with that look it's just a reminder and affirmation that you need to continue to uphold the mask and that your true self is not worthy of that person's friendship, love, admiration.
> (Tiktok user professionalaudie)

When autistic women pass as non-autistic, the short-term success they have reinforces several key themes for them: that the ableist rhetoric that they are simply "not trying hard enough" to fit in must be correct, that when they behave in a feminine and allistic way they receive praise and social attention, and that any stress, anxiety, exhaustion, or depression they feel while engaging in this behavior is not as important as how the people around them perceive them (Beck, et al, 2020; Belcher, et al, 2022). In patriarchal cultures, young girls are taught that their needs are secondary to the people around them, particularly if those people are men; they are socialized at a young age to keep their opinions to themselves, and to meet the physical needs of their fathers, brothers, etc., before their own.

Women are often diagnosed with autism later than men, and there is strong evidence to show that this is due to women internalizing the symptoms of their autism that men typically externalize and heavily masking to pass as non-autistic to avoid as much of the censure and stigma assigned to autistic behaviors (Schuck, et al, 2019; McQuaid, et al, 2022). For example,

autistic men often react to confusing social situations with outbursts of anger or frustration while women react by withdrawing into themselves and internally criticizing the way they handled the interaction (Beck, et al, 2020; Seers and Hogg, 2021). The studied narratives contain many late-diagnosed autistic women describing many social situations where they were confused in the moment about what was happening but were unable to speak up or intervene in the situation; instead, they simply said nothing and attempted to process what happened later on their own. Twitter user petricampp describes this experience. Lacking any other explanation, many undiagnosed autistic girls simply accept the buzzwords assigned to them without having any real understanding of their meaning: "When your 'mysterious and intimidating' energy is bc [because] of autism and not bc it's just your personality" (Twitter user @petricampp). The way that autistic girls internalize their symptoms can create the aura of "mysterious" described here: they are mysterious because they no longer reveal any information about themselves and they have learned from experience that anything they say is subject to criticism, misunderstanding, or bullying, and it is better to keep their thoughts to themselves wherever possible, especially when they are confused. Admitting that they don't understand what's going on is social suicide, and so autistic girls learn simply to not admit it and to swallow their lack of understanding as a problem for them to solve on their own. This silence is correctly perceived by the allistic children as intentional, and intentional silence is often coded as intimidating. In contrast, when a little boy is confused, he may decide to externalize this confusion and may lash out verbally or physically; this reaction is not considered socially appropriate in the way a girl's silence is, so it will often be immediately addressed.

This internalizing reaction is reinforced by the patriarchy. Children are typically socialized according to their gender assigned at birth, and female children are taught to be quiet, submissive, and introspective. Tiktok user wouldyakindly describes a fairly common experience of what these girls are actually thinking and doing with themselves in this silence: "All I do in my free time is watch videos about body language and people watching to know what is the more approachable way to talk to me" (Tiktok user wouldyakindly). Girls doing research on how to fit in would probably be deemed regular adolescent behavior, and not the obsessive hallmark of an autistic special interest; for a girl struggling to fit in it may even be praised as an attempt at self-help and independence. Special interests in girls tend to revolve more around books, animals, celebrities, or even an obsession with femininity itself—all of which are praised and encouraged in girls regardless of how single-mind-

ed or detrimental her obsession ends up being (Schuck, et al, 2019; Beck, et al, 2020; Seers and Hogg, 2021). The reality is that wouldyakindly may have spent a truly incredible amount of time watching videos about body language, which she may not actually specify to those she informs.

When a female child struggles with social interactions, the initial assumption often leans towards perceiving her as shy and passive, qualities typically viewed as neutral or even positive for a girl. Consequently, this lack of concern leads to a lack of further investigation into the underlying issues. (Schuck, et al, 2019; Kavanaugh, et al, 2021). "The fact that an autistic woman is verbally fluent, has IQ in the average range or above, and seems to function well does not indicate that she is functioning well emotionally. Indeed, she may be in a significant amount of distress" (Beck, et al, 2020). Young girls who are succeeding academically and not causing trouble in school (regardless of if they are successfully making and keeping friends) are not considered for evaluation for autism; additionally, because many of the hallmark traits of autism in children are written around how they manifest in boys, they are overlooked in girls and dismissed as normal development (McQuaid, et al, 2022). Many girls not only go unnoticed for potential referral for diagnosis but are also often overlooked entirely. They are so successful at becoming a wallflower that their teachers increasingly assume that they are fine without doing any checking-in. If they do have a question, they are told they are smart enough to figure it out themselves, which only further reinforces their internalizing narrative that their problems are those to fix on their own.

By the time an autistic girl reaches adolescence and young adulthood, she has had so many of her attempts to socialize go poorly and that her attempts to correct whatever is "wrong" with her often backfire, and she may develop anxiety. This is the beginning of where "not making it" enters the "faking it" portion of living with undiagnosed autism: successfully passing as non-autistic begins to break down with the emergence of anxiety, as anxiety is typically an overwhelming sensory experience for autistic people that does not leave enough room for successful social interactions. As emmalangevin describes, this anxiety is significant, detrimental, and can have serious consequences far above and beyond what an allistic person may experience: "But for some reason you're always like a weirdo and people always had an issue with you that you could never figure out what it was, and you have really really bad social skills, and you developed really bad social anxiety, and you have really bad panic attacks, and you had to drop out of high school because the anxiety was so bad" (Tiktok user emmalangevin). Social anxiety is the most common manifestation, but generalized anxiety often accompanies it; it becomes a fear

of making the wrong choices, of saying the wrong thing, of simply existing in the wrong way.

Young autistic girls are often dismissed as daydreamers, and the inattentiveness they exhibit is much quieter than the outbursts of anger and hyperactivity clinicians and educators are taught to expect from autistic boys. These girls evolve into people pleasers and teachers' pets as their blossoming social anxiety transforms into a strong desire for any form of social approval. However, being people pleasers and teachers' pets aligns with societal expectations for girls, who are traditionally expected to embody traits such as being quiet, helpful, and attentive to the needs of those around them (Belcher, et al, 2022). Undiagnosed autistic women are "more likely to attribute social challenges to personal traits rather than to traits shared with other autistic people, with the former often leading to poor self-concept and feelings of isolation" (Beck, et al, 2020). Although these behaviors may initially appear harmless—a young girl being quiet in the classroom, consistently engaged in reading or daydreaming, obediently following the teacher's instructions, and even anticipating their needs, all while maintaining a neutral social stance with no friends or enemies—when observed together, they serve as a warning sign. These girls have learned that they are less likely to be anxious if they don't try to interact with their peers and the only person who will give them any positive attention in the classroom is the teacher. If these behaviors were examined more closely, it may be revealed that she is paying abnormally close attention to the teacher and is measuring her self-worth against how helpful she is, or how quiet she can be, and that she may be on the verge of an internalized panic attack several times a day. Society loves a little teacher's pet, though, and so we label her helpfulness and attentiveness as cute, modest, and well-behaved, instead of obsessive, single-minded, or not age-appropriate.

It can probably be described as a universal experience among adult autistic women: in childhood, adolescence, and the young adult years leading up to their eventual late-diagnosis of autism, they experienced regular social repercussions, social isolation, and stigma for reasons they could never quite explain or put their finger on. Throughout her memoir, Hannah Gadsby describes being constantly and consistently criticized for her behavior and word choice, but never being able to understand how to change her behavior: "'You're doing it again.' I wanted to know what I was doing again, but I was afraid to ask. I didn't want to make it worse. I was trying my best to keep a lid on it. I always do. Sometimes I can. But never when I'm in a bad way. And I was in a bad way" (Gadsby, 2022). Her loved ones rarely attempt-

ed to explain her behavior back to her and, instead, assumed she was being intentionally rude, defiant, or contrary and censured her for that assumed intention. These interactions left Gadsby frustrated, overwhelmed, and often led to verbal meltdowns, where she would lash out, or shutdowns, where she found herself unable to continue the interaction. Being blunt and direct are widely considered typical traits of an autistic person (5th ed.; DSM–5; American Psychiatric Association, 2013). These traits come partially from the very common "black and white" thinking that the autistic mind frequently engages in; autistic folk are highly analytical and highly empathetic thinkers but can frequently trap themselves into viewing issues and topics as explicitly two-sided and struggle to partake in nuance on their own. This is often reflected in their conversational style and can come across as blunt and direct: when they view a topic as having only two sides as a matter of strict fact, they will speak with authority and clarity to that fact.

Autumn Forest Vivian, in a short story for the anthology *Loud Hands: Autistic People, Speaking* describes a set of unspoken rules autistic people are expected to understand and live by. number four addresses the conversational conflict that often arises in an autistic person's life: "#4: If there is a conflict between someone with autism and someone without autism, it's the person with autism's fault. If a person with autism gets bullied, this is evidence of why #3 is true: if no one had been able to tell they had autism, this wouldn't have happened" (Forest Vivien, 2012, pp. 249-251). Any behavior that is coded as autistic or socially undesirable will be heavily stigmatized, regardless of whether that person is diagnosed as autistic. Lerita Coleman Brown defines stigma as a relationship of superiority and inferiority (Brown, 2013); there must be someone who feels inferior for another to feel superior. Undiagnosed autistic women, as described by Gadsby, internalize from an early age the belief that their behavior is situated on the inferior side of their social relationships. They are told, and therefore come to understand, that the way they exist in the world is wrong.

As these women grow older, what started off as not being welcome to play on the playground begins to morph into specific criticisms: often, that they are too blunt and too direct and that it makes the people around them uncomfortable at best and angry at worst. "Annie's direct, she doesn't wrap things in a pretty package, it's more than direct, it's obnoxious aggression" (Tiktok user professionalaudie). Professionalaudie demonstrates the most common example of the double empathy problem: the autistic person assumes that their direct, literal, and two-sided view is accepted and understood by all parties, and the allistic person assumes that a more nuanced and

carefully padded view is accepted and understood by all parties. Autistic people are often very literal and this factors into being perceived as direct. When an allistic person speaks to something the autistic person perceives as an incorrect fact, they will typically seek to correct the record. This correction may be done via interruption and is typically direct and to the point. The autistic person does not mean this as a slight against the allistic person, but it is often perceived that way; the allistic person often will feel that the fact in question wasn't all that important, or maybe even irrelevant to the overall point they were making, and that the autistic person was correcting it just to prove that they "knew more" or are the smarter one. It can be perceived as an intimidation tactic or, even, as condescension. The autistic person will typically not understand why the allistic person then gets upset, and the allistic person will refuse to explain as they feel the slight was both obvious and intentional.

"Autistic people trying to figure out why we've unintentionally offended someone when we were just directly explaining our logical reasoning because we wanted to make sure we were clear" (Tiktok user jessiespinx). Jessiespinx describes a common feeling for autistic women: they know someone is offended, but they rarely know why. Autistic women may miss sarcasm, euphemisms, and other indirect forms of verbal communication (Milner, et al, 2019), which can be misread by an allistic person; the allistic person assumes the autistic person understood the joke or comment but didn't find it funny or relevant and is intentionally refusing to reply or acknowledge it. All too often it is the exact opposite: the autistic person simply did not understand the comment and chose not to reply because they were afraid of saying the wrong thing in their confusion. This lack of response can come across incorrectly to the allistic person as condescending, judgmental, or rude, despite the autistic person's feelings of insecurity, lack of confidence in their own social judgment, and fear of rejection.

When the autistic person is then faced with the criticism and censure from the allistic person, they are often taken aback by the anger, frustration, and irritation they are given and find themselves trapped in a spiral where the "right" social response is never quite within reach, especially if they are also being bogged down by anxiety and fear:

> "The feedback was all so standard: people found me intimidating, people thought I was judging them when I thought I wasn't. I would sometimes have these weird interactions with people that were super confusing, like I'll just be talking and then suddenly someone will be getting really mad at me, and it was really hard to try and progress my career when these things were kind of plaguing me"
> (Tiktok user professionalaudie).

Professionalaudie internalized the feedback she received and, in turn, used it as self-incrimination—that there was something wrong with the way she existed that she had to correct for herself. For an autistic person to self-censure their autistic-coded behaviors, they must first buy-in and agree that their behavior is undesirable. Brown describes that some stigmatized people can become dependent, passive, helpless, and childlike because that is what is expected of them (Brown, 2013). This is especially key in the discussion of autism, which has been historically infantilized; depictions of autism in the media and news are consistently of children and have created a false societal understanding of autism as a disability that children will grow out of. (Stevenson, et al, 2011) When children inevitably age into teenagers and then young adults who still exhibit autistic traits, they are further stigmatized for their behavior; many autistic women double-down on their attempts to pass as non-autistic as they enter adulthood.

BITCH SYNDROME

I propose a new term, "bitch syndrome," which is intended to encapsulate the experiences autistic women face at the intersection of disability and the patriarchy: the double stigmatization of failing to be feminine enough while simultaneously failing to adhere to allistic social standards. This term is needed in the autistic community because of how commonly the word "bitch' is leveraged against undiagnosed autistic women; within the small sample size of this study, it was one of the highest non-searched terms recorded. Feminist theory often views gender as a performance or as an explicit act required by our society in order to obtain and maintain social acceptance; we must "perform" as adequately feminine or masculine in the way our body looks and in the way we behave in conversation with others (De Beauvoir, 1973; Butler, 1988; Butler, 1990). Autistic women struggle to perform their gender or even to understand gender as a social construct; they are often just doing their best to pass both as non-autistic and as female which doesn't take into account the many autistic people who are also gender non-conforming. This intersection of the patriarchy and disability is especially enraging for the people in autistic women's lives and frequently inspires negative "feedback," which can include both formal feedback (such as in a workplace) and sometimes in the form of off-the-cuff comments. Autistic women dealing with "bitch syndrome" will typically also hear "intimidating" and "judgmental" levied against them, and it is necessary to examine exactly how those two words reproduce the stigma they face.

"Intimidating" is a common word leveraged against autistic women: "Ppl

[people] thinking I look really intimidating and then later telling me how my personality is nothing like how I appear" (Tiktok user hyndsyghts). This reversal, where the allistic person eventually "catches up" and realizes the autistic person is "nothing like how [they] appear," is often paired with "intimidating." It reflects the misunderstanding and assumption of an autistic person's body language and tone as intentionally socially inappropriate: "I have gotten 'intimidating' and 'intense' since I was a small child and it's clinical depression + autism = directness and flat effect. I can't help it if people are scared" (Twitter user @thekateblack). This combination of autistic traits like directness, flat tone or monotone voice, too intense of eye contact, or lack of eye contact entirely are perceived as intentionally aggressive on the autistic woman's part. In contrast, a man being labeled "intimidating" is typically viewed with a certain aura of awe: we code their intensity as powerful and their ability to scare those around them as a positive, useful trait. Under the patriarchy, women are expected to be quiet, defer to men's opinions, and when they do speak up, to do so politely and as indirectly as possible; women should not ever demand anything of someone else, but instead make requests.

"Judgmental" is a buzzword that autistic women often grapple with, stemming from misinterpretations or incorrect assumptions grounded in silence or the autistic woman's potentially inaccurate understanding of the situation: "Growing up, a lot of people considered me to be a judgmental person, and I internalized that and kinda considered myself a judgmental person. People would call me negative, judgmental, debbie downer" (Tiktok user aniyahinspires). Aniyahinspires doesn't go into detail here, but many of the descriptions of this situation involve the autistic woman adding on what they thought was an innocuous comment to a conversation and instead misreading the social dynamics of the situation. What she thought was an observation about someone may instead be perceived as an insult. Being perceived as judgmental can be seen as a betrayal of their femininity: women are supposed to be caretakers, nurturers, and empathetic nurses who love those around them unconditionally.

Tiktok user professionalaudie works in a corporate office setting, and, through a series of videos, describes trying to overcome her autism in a high-level and high-powered workplace setting:

> "The leadership coach got a 360 feedback done on me, and 360 feedback is basically where you seek feedback from all different types of people that you work with - leaders, peers and people who report to you. It had loads of really positive feedback about my passions, the things I'm really good at, but there were also a

> lot of negative comments. In fact, I counted them: there were 57 comments of negative feedback, and out of the 57 pieces of negative feedback, 54 I think were actually about my autistic traits" (Tiktok user professionalaudie).

Her allistic coworkers could not (or would not) see past her autistic traits any longer and were now holding them against her when previously they were ignored or overlooked. The specific comments she received in feedback are an unfortunately excellent example of bitch syndrome and its consequences:

> "She's really terrifying, everyone's scared she'll bite their head off. People are intimidated to engage her. People go around her to prevent confrontation. What that is all about is me asking questions so that I understand what people are talking about and before I got botox so I couldn't frown, people would think I was being confrontational"
> (Tiktok user professionalaudie).

The only thing professionalaudie takes away from this feedback initially is that she is asking too many questions, which causes people to be scared and intimidated by her. She had to get botox to freeze her face in a "pleasant" expression for her colleagues to take her questions at face value, simply as questions and not an implication that they were doing something wrong. Under the patriarchy, women are not supposed to express displeasure and they are especially not supposed to be confrontational; having an unpleasant expression on her face would be a violation of professionalaudie's performance as woman.

Bitch syndrome is a reinforcement of the patriarchy: the patriarchy requires us to police women's behavior in order to maintain the status quo and the social order wherein women are lower on the power hierarchy than men (Collins, 1990; Connell and Messerschmidt, 2005). "Bossy" is an interesting expression of this phenomenon. "When I was young my neighbor who babysat me called me 'bossy' to my parents and at the time I didn't see what the issue was" (Twitter user @foureels). A "boss," by definition, is just a supervisor, or someone who is in charge of others in a workplace. "Bossy," however, is derogatory, and implies someone is inappropriately giving orders to someone they should not. "Bossy" is an almost exclusively feminine term and only applied to women, despite the fact that people of any gender can be a "boss." User foureels being called bossy at a young age shows us that the patriarchy is constantly reinforced, even (or especially) to children. User wileemcsmiley contextualizes how bitch syndrome inspires this policing of femininity:

"Combo misogyny/thinly veiled insult compliment from a past female colleague: 'you write/speak like a man.' What she meant was that I, a woman, shouldn't be so direct in my language & needed to be softer like her" (Twitter user @wileemcsmiley). The patriarchy requires reinforcement from all participants, which includes between two women, and creates scenarios like this one where wileemcsmiley's coworker felt the need to police her behavior. Her perceived masculine behavior threatened the patriarchal status-quo.

THE ABANDONMENT OF AUTISTIC WOMEN

As undiagnosed autistic women age into adulthood and start careers, get married, have children, and all of the other important markers of life, the impact of their undiagnosed autism continues to follow them. Many autistic women will find themselves unable to achieve these life milestones at all and will feel even more alienated from their peers as they remain single and struggle to maintain employment. Those who do get married and have children may find the energy demands of marriage and small children to be overwhelming or even impossible. Adult autistic women working full-time may find themselves unable to do quite literally anything else with their lives as the demand to pass as non-autistic saps all their daily energy. Research demonstrates that efforts to pass as non-autistic never get easier or require less energy but that the opposite is in fact true: maintaining a mask and constantly monitoring your behavior is exhausting, and compounding stress from trying to maintain a false sense of "normalcy" for yourself makes it more difficult (Milner, et al, 2019; Seers and Hogg, 2022). For many of these women, an inability to make genuine friendships also follows them well into adulthood:

> "Yeah, nobody ever wants to spend time with me. So, this is something I've been trying to put into words for a long time, this weird dissonance between people telling you that you have great energy and that your way of thinking is so cool and they just think you're really neat person and showering you in all these compliments, but then also not making any moves to spend any time with you or hang out or actually like become a friend" (Tiktok user floor noidles).

Age and experience gave them a "better" mask, and they have developed scripts to follow for most social interactions, but the bar for "succeeding" in these interactions continually floats higher and higher. As Tiktok user floor noidles is describing, she can put forth her best effort—often at great personal expense—and still not manage to have the social interactions, friendships

and relationships she desires. The impact of this is difficult to quantify but is significant on a quality-of-life front. The loneliness they are experiencing has compounded into a life-long problem; making friends as an adult is difficult enough for allistic people and may as well be impossible for an autistic person to process in addition to the other demands of being an independent adult. Loneliness is most likely paired with continued and worsened anxiety and depression, especially as the weight of all the aspects of life they feel they "lack"—marriage, children, careers—become more and more burdensome.

For some undiagnosed women, there comes a specific point in adulthood where the stress and exhaustion of trying to pass as non-autistic for decades converges and then collapses around them, resulting in severe autistic burnout and eventually diagnosis. Professionalaudie, in discussing the feedback she'd received from her workplace, illustrates some of the symptoms of an impending autistic burnout:

> "She gets worse when there's too much on, when she's stressed. I leak stress onto others. I think part of it is I didn't know I was stressed and I didn't know what stress felt like because of alexithymia"
> (Tiktok user professionalaudie)

Burnout can be insidious, especially for autistic folk who struggle to meet their bodily needs in the first place; for autistic women who are prioritizing the needs of others, it may appear to sneak up on them from behind. The stress that professionalaudie references is not a stress she realized she had in the moment, and she had to be told by her colleagues that they not only noticed it, but were feeling it themselves. This alexithymia, defined as an inability to process or understand one's own emotions and feelings, is very common for autistic folk and can be especially damaging in the wake of burnout. Trained since childhood to ignore their wants, needs, and desires, autistic women will push far past their body's tolerance for stress. This can and will cause their ability to pass as non-autistic to fail completely and may worsen some of their autistic behaviors that are associated with regulation, such as the need to stim. These are signals from their body that they are deeply dysregulated and need to take better care of themselves but will go ignored by many autistic women who are dedicated to maintaining an appearance of "normalcy" that the stigma they are up against demands of them. Some women are capable of recovering from this burnout because they are repeatedly let go from jobs and are forced to take time off to find a new role, which results in an unintended recovery period. Some women find themselves chronically ill and hospitalized because of the ongoing, long-term stress and lack of care

for their body; it is not uncommon for autistic folk to have a repeat history of chronic infections because of their ignorance of their body's needs.

Late diagnosis is associated with a wealth of problems for autistic women. Many women, post-diagnosis describe their former selves as passive and feeling as if they were lacking in agency in their own lives and decisions (Bargiela, et al, 2016; Leedham, et al, 2020). This in line with Brown's description of the long-term impacts of disability stigma (Brown, 2013). Diagnosis gives many of these women their agency back: it gives them the knowledge and the context to understand and frame the events of their lives as "not their fault," allows them to research autism, develop supports and accommodations for themselves, and to start to set expectations for their social interactions. Gadsby demonstrates this by saying, "I do my best not to bruise other people's feelings with my bluntness, but now I make sure that my boundaries are clear: if you don't want me to be blunt with you, don't engage me in difficult conversations in public spaces with polished concrete floors" (Gadsby, 2022). This boundary that Gadsby sets here is an excellent example of the self-awareness that diagnosis can bring, and the subsequent relief it can be to one's stress levels. "Polished concrete floors" refers to a longer story that Gadsby talks about how that specific style of floor is a nightmare for her. Post-diagnosis, she can now label those feelings as a sensory problem due to being autistic, and instead of having moments where she is blunt and perceived as rude for what seemed to be "no good reason," she can avoid her sensory triggers where possible. Where it isn't possible, she can inform those around her of the trigger and set a boundary that she shouldn't be engaged in serious conversation while she is processing being uncomfortable. This knowledge shifts the blame from the autistic woman to the world around her, where it belongs: much of the physical environment we have built is inaccessible for autistic folk, who, by the grace of a biological quirk, are forced to intake much more information about the world around them than an allistic person. It is not wrong or right, but merely is; understanding autism allows the autistic person to let go of the guilt, and often much of the anxiety, that comes from not understanding your own behavior.

Diagnosis for many women arrives well into adulthood and often comes far too late to prevent some of the worst consequences of living with undiagnosed autism. Constant attempts to pass as non-autistic can result in what researchers refer to as a "loss of authentic self," which is typically comorbid with severe anxiety, depression, and other mental health diagnosis. Poor mental health, a loss of a sense of self, and the development of a passive social personality often culminate in being extremely vulnerable to abuse, particu-

larly sexual abuse (Bargiela, et al, 2016; Milner, et al, 2019; Leedham, 2020; Seers and Hogg, 2022). Many women are reluctant to share their diagnosis with their friends, family, and employers, fearing further dismissal of their experiences or increased discrimination due to autistic stigma (Leedham, et al, 2020); for some, it is easier to remain "in the closet" about being autistic than it would be to have to convince someone of their invisible disability (Samuels, 2003). Much like "coming out" as gay, Samuels reminds us disability is discriminated against in many of the same ways. Society wants you to keep it to yourself, to not bother anyone with your different or unexpected needs, and to not complain about your lot in life and to simply be content with being allowed to be present. It is difficult for a late-diagnosed autistic woman to fight back against that narrative, especially when the nature of the late diagnosis has kept her from developing the self-confidence needed to be comfortable asserting yourself loudly and proudly as autistic. Society has also persisted in keeping the narratives around autism focused on loud little boys, meaning when an adult woman identifies herself as autistic, there is no automatic or boilerplate reaction for allistic people to lean on. They don't know what to say, and often their first reaction is to lean into autistic stigma and stereotypes: "You can't be autistic," "You don't look autistic," "You don't act like my autistic nephew." The autistic woman is now in a position of having to defend herself and her diagnosis, much like she has had to defend her behavior her entire life. Despite now understanding herself, this common interaction is not immediately any easier to handle. Diagnosis often comes with a significant calming of the anxiety, depression, and symptoms of stress and burnout that these women experience, but it does not prepare them for the now overt exclusion they will face from some of their community.

CONCLUSION

Late diagnosis is common in women because it is perpetuated by their intense efforts to pass as non-autistic, which in turn are perpetuated by the patriarchy and disability stigma. Young undiagnosed autistic girls are trained to be feminine in ways that distort and hide their autism, and, as they age, their disability gradually becomes debilitating. Lack of diagnosis forces them to internalize their symptoms in ways that produce high levels of anxiety and depression, and eventually results in autistic burnout that prevents them from leading the lives they want for themselves.

The stigma surrounding autism in our society is powerful. When that stigma interacts with the patriarchy, it can ravage a woman's life decades before she ever thinks to herself, "could I be autistic?" The patriarchal gender

socialization that we impart on children has an almost gaslighting effect on young autistic girls, who try their hardest to fit in only to be told they're not trying hard enough. Disability and autistic stigma are so strong and so prevalent that even hallmark signs of autism are dismissed as "she's just a little quirky." The idea that a little girl could qualify for a diagnosis is, for many adults, incomprehensible. The societal depiction of autism continues to be perpetuated as a young boy having a meltdown in a public location or of an older male prodigy à la Sheldon from the *Big Bang Theory*. We have made no room in that depiction for our young girls: the daydreamers, the teachers' pets, the special-interest horse girls, or the talkative know-it-alls. We overlook them and the inner worlds they have created in their minds to live in, content to let them passively disengage until the moment when that disengagement turns into an inability to function in their required environments of school, work, and home.

The late diagnosis of autistic women is not an inexplicable phenomenon. It is borne out of the patriarchy's determination of women as second-class social citizens, and the behavioral expectations we place on women to be quiet, obedient, to have interests within a set classification of topics, to be nurturers and caretakers, and to place their needs always behind the people around them, particularly men. It is borne out of anti-disability stigma, where we believe, as a society that being born or becoming disabled is the worst possible thing that could happen to someone. It is borne out of anti-autistic stigma above and beyond anti-disability stigma, because there is absolutely nothing worse than being disabled and having it alter the way you interact with others in the world. Being different puts a target on your back in the United States, and being loudly, visibly, and unknowingly different makes that target hard to miss. The power dynamics that influence autistic women's interactions every day, for decades, are often difficult for them to see and understand, but they are aware of their presence regardless and feel their negativity sitting just underneath the skin. The specter of neurotypical, patriarchal expectations follows them wherever they go.

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06

Recovering from hypoxia-induced metabolic suppression: Role of N-myc Downstream Regulated Gene 1a in Na+/K+/ATPase restoration from the cytosol to the plasma membrane

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BIOGRAPHY

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RESEARCH JOURNEY

I came to UMBC knowing that "research" was an important concept for future scientists, but it was an abstract concept; I could only picture a hazy image of serious, lab-coated people handling colorful chemicals. While taking genetics during the spring of my freshman year, "research" began to solidify itself as the process of discovering new knowledge, and I decided I wanted to be involved. Reading through UMBC biology professors' research interests, I found that the Brewster Lab's focus on neuroscience and development using zebrafish as a model organism was calling my name. That summer, I began working with a graduate student to "fill in the blanks" of his nearly complete dissertation, and learned several techniques that I have been continuously perfecting through my two years in the lab. My project was ultimately a culmination of that first summer's project, attempting to understand the genetic and molecular mechanisms whereby zebrafish can survive hours of zero oxygen conditions, and continue to develop normally when returned to a normal oxygen environment. Importantly, I learned that to "do" research is to tell a story.

ABSTRACT

Oxygen plays a life-critical role in oxidative phosphorylation. Zebrafish embryos, however, can survive nearly fifty hours in a zero-oxygen (anoxic) environment by entering a state of metabolic suppression characterized by metabolic arrest of ATP-demanding processes, such as ion pumping driven by the sodium potassium pump (NKA). The Brewster Lab has previously shown that the N-myc Downstream Regulated Gene 1 (NDRG1) mediates NKA downregulation in the embryonic kidney and ionocytes, allowing for embryonic energy conservation. Here, I explore the question of whether Ndrg1a promotes the return of membrane NKA levels upon re-oxygenation after sustained anoxia, using the proximity ligation assay (PLA) to detect whether these proteins interact *in situ*. I focus on ionocyte morphology because qualitative analysis of these structures allows for direct assessment of protein subcellular localization. I hypothesize that if Ndrg1 is required for NKA recycling or exocytosis post- anoxia, then these proteins should remain associated throughout re-oxygenation, transitioning from the cytosol to the plasma membrane over time; this is consistent with known protein trafficking roles of NDRGs. My preliminary data (n=2) reveal a significant shift in NKA localization. In contrast, PLA signal remained relatively consistent over time, suggesting an NKA-Ndrg1a interaction confined to the cytosol. These findings suggest that NDRG1, acting as a versatile adapter protein and environmental oxygen-lactate sensor, may play a role in intracellular trafficking of NKA to mediate post-metabolic-arrest survival. Identification of the subcellular compartments where these proteins interact will further our understanding of the role of Ndrg1a in hypoxia adaptation.

INTRODUCTION

Oxygen is critical for life, acting as the final electron acceptor during oxidative phosphorylation. Unsurprisingly, ischemia—a lack of blood flow—is a leading cause of death in humans. Strokes, for example, are often fatal or severely debilitating due to dysregulation of brain metabolic function (Nathaniel et al. 2015). Animals living in low oxygen conditions, however, exhibit hypoxia tolerance. The North American freshwater turtle, for example, likely evolved this characteristic from living in mud at the bottom of lakes, and the Arctic ground squirrel likely displays hypoxia resistance related to a transition out of winter hibernation (Nathaniel et al. 2015). The zebrafish, *Danio rerio,* embryo is anoxia-tolerant and survives nearly fifty hours of anoxia by entering into a state of reversible metabolic arrest, characterized by a downregulation of energy-demanding processes, notably Na^+/K^+/ATPase (NKA), the ubiquitous ATP-demanding ion pump (Park et al., 2022).

At the metabolic level, hypoxia results in energy-reprogramming via glycolysis, leading to increased lactate levels and acidosis (Feala et al., 2009). Research using *Drosophila melanogaster* determined that hypoxia-adapted flies enter a state of metabolic suppression partially characterized by lower glycolytic flux and increased movement through Complex I (Feala et al. 2009). Importantly, adapted flies exhibited greater ATP-generating efficiency, highlighting reduced energy use as a marker for cellular adaptation to hypoxia, as organisms such as *D. rerio* and *Caenorhabditis elegans* (which reduces protein translation mechanism under hypoxia) also demonstrate (Feala et al. 2009). Although hypoxia-tolerant organisms are known to regulate cellular processes at the transcriptional, protein accumulation, and nutrient use levels, among others, much remains unknown, including detailed oxygen-sensing and epigenetic mechanisms (Lee et al., 2020).

Ischemia, among other pathologies, stems from hypoxia. In particular, metastatic cancers—in which blood flow is redirected through angiogenesis or vessel co-option—give rise to solid tumors with hypoxia-adapted phenotypes because their blood vessels do not efficiently perfuse through tissues (Lee et al., 2020). At the transcriptional level, human cell culture studies report that hundreds of genes are up-regulated in a hypoxia-inducible factor 1 (HIF-1)-dependent manner, chromatin immunoprecipitation revealing a binding interaction between HIF-1 and these oxygen-sensitive genes (Semenza, 2013). HIF-1 is a heterodimer with alpha and beta subunits and is expressed in all known metazoans; it plays an essential and evolutionarily conserved role (Semenza, 2012). Under normoxic conditions, HIF-1α is ubiquitinated and marked for proteasomal degradation following binding

of von Hippel-Lindau protein to two hydroxylated proline residues on HIF-1a. Because the hydroxylation reactions utilize oxygen and α-ketoglutarate as substrates, under hypoxia, enzymatic activity is inhibited, leading to an increasingly stabilized and transcriptionally active HIF-1α. In human cell culture and ventilated lung preparations, oxygen concentrations below six percent (adult tissues are usually at three to five percent) correlated with exponential increases in HIF-1α levels (Semenza, 2013).

Among the HIF-1α target genes are the hypoxia-inducible members of the N-myc-downstream-regulated gene (NDRG) family. NDRGs, belonging to the α/β-hydrolase superfamily, are likely enzymatically inactive due to a non-existent catalytic triad (Le et al., 2021). Among other processes, NDRG1 is involved with multiple disease states (Tu et al., 2007). NDRG1 deficiency is linked to Schwann cell pathology; Charcot-Marie-Tooth (CMT) disease, the most common inherited neurological disorder, characterized by muscular degeneration and loss of touch sensation in the extremities, is linked to autosomal recessive *NDRG1* mutations (Melotte et al., 2010). It is also suggested that *NDRG1* acts in tumor metastasis pathways (Le et al., 2021), with studies in pancreatic cancer indicating its possible function in suppression of the metastatic cancer (Angst et al., 2006). Given the hypoxic nature of tumorigenesis, and known interactions between HIF-1α and NDRGs, HIF-1 inhibitors are a growing focus of cancer therapeutic development (Semenza, 2012).

Molecular transport via vesicle trafficking is key for cellular communication, among other biological processes (Wu et al., 2016). Although endosomal development mechanisms are largely unknown, several key steps are known (Rink et al. 2005). Endocytosed cargo may be recycled to the plasma membrane via low-density lipoprotein receptors or prepared for degradation via late endosomes into the lysosome. SNAP Receptors (SNAREs) and Ras-associated binding proteins (Rabs) are both linked as key regulators in these processes; Rab GTPases act in membrane tethering upstream of SNARE proteins (Rink et al. 2005). NDRGs—found in diverse cellular locations including the cytosol, plasma membrane, nucleus, and inner mitochondrial membrane—are also implicated as adaptor proteins in vesicle trafficking (Askautrud et al., 2014). Studies have found these proteins involved in tumor metastasis, motor neuropathies like Charcot-Marie-Tooth Disease, and CDC42 (a Rho GTPase) activity (Askautrud et al., 2014).

Mammals express *NDRG 1-4,* while zebrafish genomes, which have undergone three rounds of genome duplication, encode six paralogues: *ndrg1a, 1b, 2, 3a, 3b, and 4* (Le et al., 2021). In the zebrafish embryo, *ndrg1a* mRNA is up-regulated ninefold under prolonged (12 hours) of anoxia, or zero ox-

ygen (Le et al., 2021). In the zebrafish larvae, the gene is expressed in the embryonic pronephric duct (i.e. kidney) and ionocytes, which maintain ion gradients. Both organs are energy-demanding, exhibiting high NKA levels (Park et al., 2022). There is a demonstrated Ndrg1a-NKA overlap in these embryonic organelles; although *ndrg1a* is not implicated in their differentiation, loss of *ndrg1a* disrupts kidney function in zebrafish. Compared to wild type (WT) embryos, however, *ndrg1a*$^{-/-}$ mutants exposed to prolonged anoxia and subsequent reoxygenation display increased levels of edema and renal damage. This indicates that *ndrg1* is implicated in renal function and plays a protective role in the kidney and ionocytes in response to prolonged hypoxia. Key to embryonic hypoxia survival via metabolic reprogramming is a downregulation of NKA via lysosomal and proteasomal degradation, which is an Nrg1a-dependent process. Ndrg1 thus functions in long-term adaptation to hypoxia (Park et al., 2022).

Here, I seek to understand Ndrg1a's function in embryonic survival post-anoxia. Although seemingly counterintuitive, the reintroduction of oxygen can result in oxidative stress due to the production of reactive oxygen radicals (Le et al., 2021). A previous study demonstrated a hypoxia-dependent transcriptional regulation of *ndgr1a* and transcriptional upregulation during post-anoxia reoxygenation, indicating a possible protective role by Ndrg1 (Le et al., 2021). Ndrg1 may also function in the exocytosis and recycling of membrane proteins (especially NKA) during reoxygenation, as indicated by findings from Kachlap et al. (2007) on an Ndrg1-Rab4 interaction. My data indicate that in the first three hours immediately following prolonged anoxia Ndrg1a-mediated NKA downregulation is reversed and NKA is restored to a functional position on the cell membrane of the kidney and ionocytes, marking metabolic arrest as an adaptive process. I did not find a significant increase in the interaction between Ndrg1a and NKA over time, or a change in the subcellular localization of that interaction. These results suggest that Ndrg1a is likely playing a role in protein trafficking during reoxygenation, consistent with studies finding that NDRG1 is a Rab4a effector in endosomal and recycling pathways and that NDRG1 spatially overlaps with recycling e-cadherin (Kachhap et al., 2007).

RESULTS

NKA DEGRADATION UNDER ANOXIA IS REVERSIBLE DURING REOXYGENATION

It has previously been shown that NKA is part of a channel arrest response to hypoxia, including oxygen-sensitive changes in the protein's and other redox-sensitive kinases' phosphorylation states (Bogdanova et al., 2016). As part of the metabolic suppression response, zebrafish embryos exposed to prolonged anoxia also exhibit NKA downregulation (Park et al., 2022). We found that this downregulation is reversible upon reoxygenation. Although anterior pronephric duct NKA levels are nearly completely downregulated, posterior pronephric duct retains significant NKA levels even after prolonged anoxia (Park et al., 2022). Using 24 hours post fertilization (hpf) embryos subjected to 12 to 18 hours of anoxia, and fixing embryos at zero, one, and three hours post-anoxia (n = 2), I found that both posterior and anterior pronephric duct NKA levels were elevated 1.63- and 1.46-fold, respectively, after three hours of reoxygenation (*Figure 1)*.

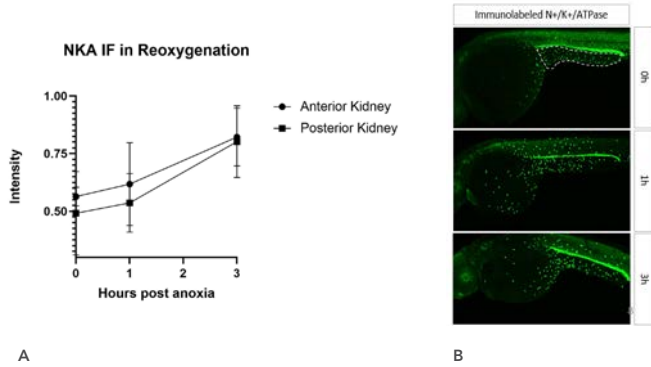

FIGURE 1.

NKA degradation under anoxia is reversible during reoxygenation. **(A)** *Posterior and anterior pronephric duct NKA levels elevated 1.63 and 1.46 fold, respectively, after 3 hours of reoxygenation. 24 hpf embryos were fixed after 12-18 h of anoxia at 0, 1, and 3 h post anoxia. N = 2, with 5-10 embryos per experimental group. An unpaired t-test was performed: p-value = .6661, ns, SEM = .1249.* **(B)** *Lateral views of representative wholemount 24 hpf embryos treated to 12-18 h anoxia and fixed at 0, 1, and 3 h post anoxia. Region of interest for tail ionocyte analysis is marked.*

NKA LOCALIZATION SHIFTS FROM THE CYTOSOL TO THE PLASMA MEMBRANE DURING REOXYGENATION

Although not as detailed as sectioning, ionocyte morphology analysis provides insight into the subcellular localization of proteins. Ionocytes with puncta (dot) versus torus (donut) morphology reveal proteins localized within the cytosol or plasma membrane, respectively. Using 24 hpf embryos subjected to 12 to 18 hours of anoxia, and fixing embryos at zero, one, and three hours post-anoxia ($n = 2$) and focusing on the embryonic tail, I found an increase in donut ionocytes (*Figure 2*).

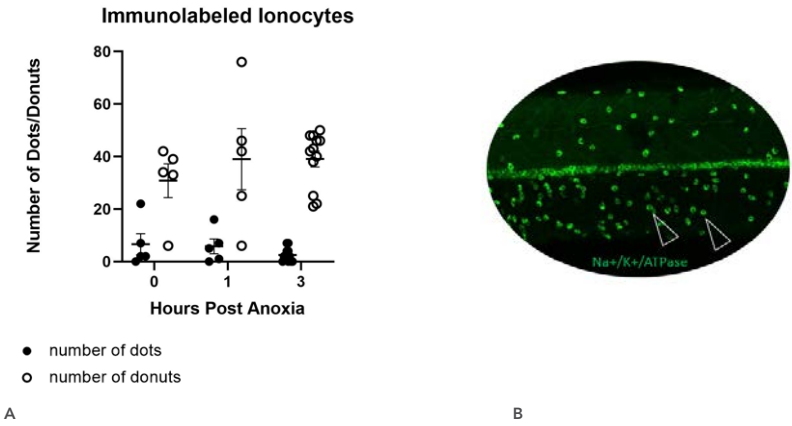

FIGURE 2:

*NKA localization shifts from the cytosol to the plasma membrane during reoxygenation. (A) Number of donut ionocyte increases over time during reoxygenation. 24 hpf embryos were fixed after 12-18 h of anoxia at 0, 1, and 3 h post anoxia. N = 2, with 5-10 embryos per experimental group. An unpaired t-test was performed: p-value < .0005, ***, SEM = 3.020. (B) Lateral view of representative wholemount 24 hpf embryo, highlighting NKA-immunolabeled donut ionocytes.*

THE NKA-NDRG1 INTERACTION IS CONCENTRATED IN THE CYTOSOL DURING REOXYGENATION

It has previously been reported that in 24 hpf zebrafish embryos, Ndrg1a and NKA interact during hypoxia and interact with increasing strength over longer durations of hypoxia, suggesting that hypoxic NKA downregulation is Ndrg1a-dependent (Park et al., 2022). Additionally, *ndrg1a* -/- mutants were found to die or develop renal damage and/or edema at higher rate than wild type (WT) upon reoxygenation, indicating a protective role for Ndrg1a. Us-

ing proximity ligation assay (PLA), which labels protein-protein interactions to the 40 nm level, I found that in 24 hpf embryos subjected to 12 to 18 hours of anoxia, and fixing embryos at zero, one, and three hours post-anoxia (n = 2), pronephric duct label changes insignificantly, and the number of tail donut ionocytes remains relatively unchanged (*Figure 3).* This suggests that Ndrg1a may enter an endosomal trafficking role upon reoxygenation.

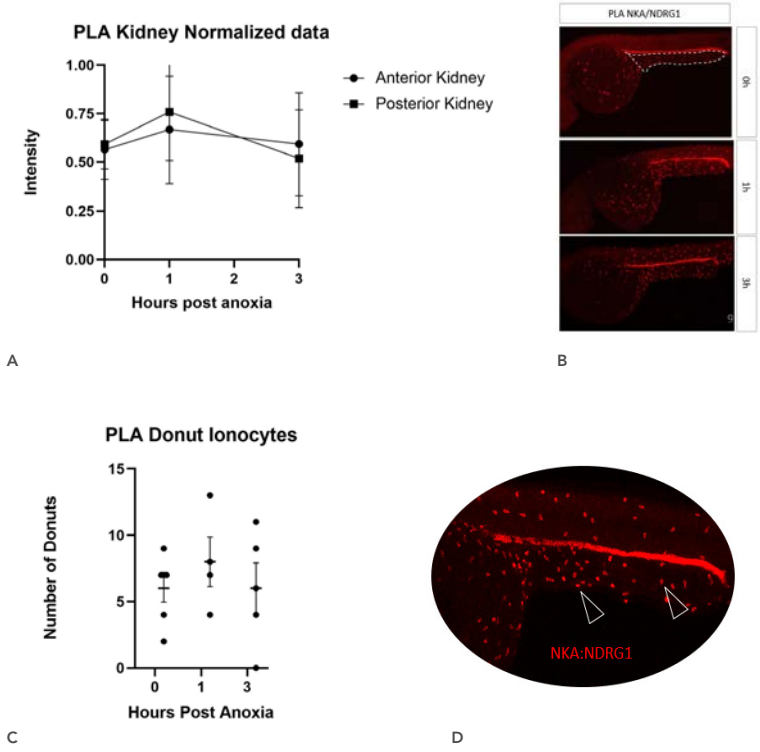

FIGURE 3:

*The NKA-NDRG1 interaction is concentrated in the cytosol during reoxygenation. (A) No significant change in pronephric duct NKA-Ndrg1 interaction. 24 hpf embryos were fixed after 12-18 h of anoxia at 0, 1, and 3 h post anoxia. N = 2, with 4-7 embryos per experimental group. An unpaired t-test was performed: p-value = .8545, ns, SEM = .07749. (B) Lateral views of representative wholemount 24 hpf PLA-labeled embryos treated to 12-18 h anoxia and fixed at 0, 1, and 3 h post anoxia. Region of interest for tail ionocyte analysis is marked. (C) ** significance change in PLA ionocyte morphology. 24 hpf embryos were fixed after 12-18 h of anoxia at 0, 1, and 3 h post anoxia. N = 2, with 4-7 embryos per experimental group. A one-sample t-test was performed: p-value = .0099, **, SEM of discrepancy = .6667. (D) Lateral view of representative wholemount 24 hpf embryo, highlighting NKA-Ndrg1 PLA-labeled ionocytes.*

DISCUSSION

NDRG1 is a hypoxia-sensitive stress response gene regulated by the binding of HIF-1α, and due to the hypoxic nature of solid tumors, is implicated in metastasis suppression (Wang et al., 2013). In prostate cancer cells, NDRG1 is further implicated as a Rab4 effector in recycling endosomes (Kachhap 2007). Additionally, Ndrg1a plays a protective role in the zebrafish anoxia response, facilitating metabolic arrest via NKA downregulation (Park et al., 2022). I initially hypothesized that Ndrg1a continues in this function as the organism returns to normal oxygen conditions. From ionocyte morphology analysis after zero, one, and three hours of reoxygenation I instead propose a model in which Ndgr1a enters a protein trafficking role, recycling NKA from the cytoplasm—evidence points to the existence of subcellular pools containing nearly a third of total cellular NKA—to the plasma membrane (Efendiev et al., 2007).

This model is limited by its basis in ionocyte morphology. This method is a proxy for subcellular analysis of protein-protein interactions. These conclusions will therefore be enhanced by future studies performing kidney cross-sections of PLA-labeled embryos along with markers for subcellular structures. Furthermore, PLA is highly sensitive compared to immunolabeling. These assays are also limited in that they measure protein levels, rather than protein turnover rate; a high protein turnover rate may create the illusion that protein levels are not upregulated or changing. Additionally, what we interpret as protein translation (as in the case of possible *de novo* synthesis of NKA) upon reoxygenation may instead be a high protein turnover rate occurring under hypoxia, which is not measured by our assays. Proteomics studies suggest the use of isotope-labeled amino acids and mass spectrometry to better understand protein kinetics (Pratt et al., 2002).

NDRGs are highly conserved and implicated in a range of cellular stress response pathways, including mitigation from hypoxic injury and metastasis suppression (Wang et al., 2013). These studies serve to further our understanding of the molecular mechanisms of hypoxic recovery, leading to novel therapeutic approaches for the mitigation of hypoxic and reoxygenation injuries.

MATERIALS AND METHODS

NOTE:
Replicated and adapted from Park et al., 2022

ZEBRAFISH HUSBANDRY

Wild type (WT) zebrafish (*Danio rerio*) of the AB strain were reared and manipulated using protocols approved by the Institutional Animal Care and Use Committee at the University of Maryland, Baltimore County. Fish were maintained in UV-irradiated, filtered water and exposed to a 12:12 light/dark cycle.

LABELING PROCEDURES AND IMAGING

IMMUNOLABELING

Embryos were fixed in 4% paraformaldehyde (PFA) at 4 °C overnight and washed in 1x PBS three times for 20 min. Fixed embryos were permeabilized with cooled acetone for five minutes at –20 °C, followed by a five-minute wash in 1x PBS. Embryos were then incubated in Inoue blocking solution for one hour at room temperature (RT) on a rotating platform (80 RPM). Incubation in primary antibodies was performed in I-buffer solution (1% normal goat serum, 2% bovine serum albumin, 1.25% Triton X-100, in 1x PBS) for two days at 4 °C on a rotating platform (80 RPM). Embryos were then washed three times for 20 minutes with 1x PBS at RT. Secondary antibodies, diluted in I-buffer, were applied for one day at 4 °C on a rotating platform (80 RPM). After secondary antibody incubation, embryos were washed three times for 20 minutes with 1x PBS for 30 min.

Primary antibodies: anti-NDRG1 at 1:100 (Sigma Aldrich, catalog number HPA006881, lot number A69409, rabbit polyclonal), anti-NKA at 1:50 (DHSB, catalog number a5s, lot number 10/17/19, mouse monoclonal), *Secondary antibodies*: Goat anti-rabbit Alexa Fluor 594 (Abcam, catalog number ab150080, lot number GR3373513-1) at 1:200, Goat anti-mouse Alexa Fluor 488 at 1:100 (Abcam, catalog number ab150113, lot number GR3373409-1).

WHOLE-MOUNT PROXIMITY LIGATION ASSAY (PLA)

PLA was performed using the PLA Duolink kit (Sigma Aldrich, catalog number DUO92101) to identify protein-protein proximity and thus interaction. All steps were performed in 96-well plates, 40µl final volume, at , rotating (80 RPM). Embryos were incubated in primary antibody solution at RT overnight. Embryos were then treated with Duolink PLA probes at RT overnight, followed by incubation in the ligation solution at RT overnight and one hour at 37 °C. Between primary antibody, Duolink PLA probe, and ligation solution incubations, samples were washed three times for 20 minutes with 1x Wash Buffer A at RT, rotating. Embryos were incubated in the amplification solution at RT overnight, followed by one hour at 37 °C. Lastly, samples were washed three times for 20 minutes in 1x Wash Buffer B at RT, rotating, then in 0.01x Wash Buffer B at RT for five minutes. Samples were stored in .01x Wash Buffer B at 4 °C.

CONFOCAL MICROSCOPY

For lateral views, 24 hpf embryos were mounted in either 1x PBS (for immunolabeled embryos) or .01x Wash Buffer B (for PLA embryos) glass-bottom culture dishes with size number 1.5 coverslips (Mattek, catalog number P50GC-1.5–14 F). Images were captured with a 10X air objective lens using an inverted SP5 laser scanning confocal microscope (Leica Microsystems). Images were analyzed and processed using FIJI ImageJ (NIH). When comparing protein levels between embryos in the same experimental repeat, all specimens were processed using identical settings, including gain.

ANOXIA AND REOXYGENATION TREATMENTS

ANOXIA

Oxygen levels were controlled using a PLAS LABS' Controlled Environmental Chamber (model number 856-HYPO). A combination of pure nitrogen (N_2) (Airgas) and room air was perfused into the chamber and resulting oxygen concentrations were measured using the PLAS LABS' built-in oxygen sensor. Additionally, a portable oxygen meter (Yellow Springs Instruments (YSI) Item number 626972) was placed inside of the hypoxia chamber to directly monitor oxygen levels in E3 embryo medium. E3 medium was placed in the PLAS LABS chamber in a beaker and aerated using an air pump to accelerate equilibration of dissolved oxygen levels with the chamber's ambient oxygen level for 12 hours before experimentation.

ANOXIA SURVIVAL

Survival was determined following anoxia exposure. A "dead phenotype" includes darkened/opaque appearance, tissue damage, swollen body with extensive edema, and detached yolk. These were discarded and not used in labeling procedures. Embryos that survived anoxia were transferred to normoxic water and washed three times with normoxic water to ensure reoxygenation.

QUANTITATIVE ANALYSIS

FLUORESCENCE INTENSITY MEASUREMENTS OF THE PRONEPHRIC DUCT AND TAIL IONOCYTES

Using Fiji ImageJ (NIH), regions of interest (ROI) around the anterior and posterior ducts of the kidney were drawn to measure fluorescence intensity corresponding to NKA and Ndrg1a protein levels using lateral views of immunolabeled embryos.

PUNCTA AND DONUT MEASUREMENTS

Using Fiji ImageJ (NIH), a region of interest around the entire tail region inferior to the kidney was drawn. The total number of ionocytes was counted, as well as the number of ionocytes displaying either puncta (dot) or donut geometry.

STATISTICAL ANALYSIS

Prism Graphpad 9 was used for all statistical analysis and figure generation. An unpaired *t*-test was used when comparing means of two independent groups, and a one-sample *t*-test was used to determine significance of the mean in a single population.

ACKNOWLEDGEMENTS

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07

A place for linguistics in combating disinformation by audio deepfakes

Chloe Evered

Dr. Christine Mallinson

LANGUAGE, LITERACY,
AND CULTURE PROGRAM

BIOGRAPHY

Chloe Evered is a current senior at Georgetown University enrolled in an accelerated master's program in linguistics. She completed a summer REU program at UMBC researching deepfake audio as part of an interdisciplinary team of linguists, machine learning experts, and data scientists. Chloe would like to thank Dr. Christine Mallinson and Lavon Davis at UMBC, as well as Dr. Jen Nycz at Georgetown University, for their tremendous support.

RESEARCH JOURNEY

With the unprecedented proliferation of language technology in the past few years, I found myself developing a strong interest in applications of linguistics to the societal challenges these technologies present. The summer after my junior year, I was thrilled to have the opportunity to work on a team of researchers at UMBC studying detection and discernment of audio deepfakes through an REU program. Our interdisciplinary research team includes experts in sociolinguistics, data science, and machine learning. Linguists with backgrounds in variationist sociolinguistics listened to hundreds of clips of genuine and spoofed speech and came up with five features of spoken English that can help listeners differentiate real speech from deepfakes. These features were applied for two purposes: to develop a training program to help equip individuals with an enhanced ability to catch audio deepfakes and to augment and improve automatic deepfake detection methods. Over the course of my work on this project, I have come across specific areas where linguistics can play an essential role. This project is ongoing and funded by the National Science Foundation Award #2210011.

ABSTRACT

Deepfakes and their potential as vehicles for deception and disinformation pose some of the most pressing new challenges of our time. This paper includes a review of existing literature on automatic detection and human discernment of audio deepfakes in particular and identifies three major areas that lend themselves to further study. These areas include (1) the interaction between a voice's gender and our ability to accurately identify it as fake or real, (2) how an understanding of language variation is relevant to the issue of deepfake detection and discernment, and (3) the potential for socio-variationist and perceptual linguistic principles to be incorporated into educational programs that improve listeners' ability to differentiate between genuine speech and deepfakes. Findings support a crucial role for linguists to play in addressing the broader societal challenges surrounding misinformation and disinformation.

INTRODUCTION

Deepfakes refer to content that is generated or manipulated with artificial intelligence (AI). In recent years, deepfakes have become increasingly widespread as mechanisms for deception, misinformation, and disinformation. Audio deepfakes in particular have been deployed in criminal activities, including phishing, blackmail, bypassing voice authentication systems, manipulating financial markets, and more (Bateman, 2020; Caldwell et al., 2020; Mirsky et al., 2022). Despite this, audio deepfakes, at this point in time, remain understudied compared to their video and image counterparts (Khanjani et al., 2023).

BACKGROUND

Existing approaches to detecting audio deepfakes largely rely on automatic methods, which include deep neural network architectures such as ResNet (Chen et al., 2017) and Temporal Convolutional Networks (TCN) (Khochare et al., 2022). In a review of current state-of-the-art voice spoofing countermeasures, Khan et al. (2023:S560) found that automatic detectors' performance varies drastically across different datasets, concluding that there is a "dire need" for comprehensive and generalizable countermeasures. Furthermore, current methods that rely on automatic detection are "brittle" (Mai et al. 2023) and can be disrupted by adversarial models. As an alternative to relying solely on automatic detectors, more attention can be paid to improving human listeners' ability to identify fake speech when they encounter it in daily life. However, little is known about how well humans are able to detect fake speech, how confounding factors make discernment difficult, and human listener strengths and blind spots compared to machine detectors. Deepfakes are becoming an increasingly powerful and prevalent vehicle for the proliferation of misleading content, and the general public needs to be equipped with an ability to discern fake audio for themselves.

Research from the field of sociolinguistics provides evidence that individuals' perceptual abilities can be honed and improved with training. For example, linguists Linebaugh and Roche (2013, 2015) provided speakers for whom English was not their home language with training to enhance their ability to produce challenging English sounds, which not only improved their ability to produce such sounds but also enhanced the speakers' ability to perceive and distinguish between them. Linguistic perception can be augmented through training; thus, an individual may be able to better identify fake speech when equipped with enhanced perceptual linguistic abilities. This in-

sight provides the motivation for the following review of existing literature on audio deepfake discernment, in the hopes that utilizing knowledge from the field of linguistics in order to enhance both human ability to perceive deepfakes and automatic methods of deepfake detection may provide a promising avenue for combating this mode of mis- and disinformation.

Existing literature on audio deepfake detection and discernment reveals three major areas that lend themselves to further investigation by linguists. These include the interaction of an AI-generated voice's perceived gender with listeners' ability to discern deepfakes from real speech, how language variation and linguistic diversity relate to the issue of deepfake detection and discernment, and the potential for socio-variationist and perceptual linguistic principles to be incorporated into educational programs that seek to improve listeners' ability to differentiate between genuine speech and spoofs. These three areas necessitate that linguists engage in this area of research by contributing an understanding of gender as it relates to sociolinguistic variation and speech perception, utilizing their expertise in non-standard forms of language and languages other than English and developing accessible public-facing educational programs.

GENDER AND SPEECH PERCEPTION

It is well-established in literature from variationist sociolinguistics—the study of how language varies along social lines—that a speaker's gender affects how a listener perceives and processes language, even of phonemic boundaries (Strand, 1999). Thus, it stands to reason that a deepfake voice's perceptible gender would impact how human listeners recognize it as real or fake. However, it remains uninvestigated how the perceived gender of a deepfake voice may or may not correlate with listener discernment accuracy.

There is extensive literature on gender and synthesized voices used for voice assistants like Siri, Cortana, and Alexa, as well as on the social implications of the common practice of gendering voice assistants as female (Specia, 2019). Although synthesized voices do not have socially assigned human gender identities, users tend to anthropomorphize and assign gender to virtual assistants, despite efforts by developers to refrain from gendering these systems (Abercrombie et al., 2021; Williams et al., 2023). Furthermore, Obinali (2019) found that the "vocally identifiable gender" of a voice assistant impacted users' degree of information acceptance: users, regardless of gender, were more receptive to information given by a voice perceived as female. Given this, it is possible that perceptually female deepfake voices have more deceptive power: if human listeners are more inclined to trust a female voice, they

may also be inclined to label a fake female-sounding voice as real.

Studies have also investigated gender difference as it relates to the issue of deepfakes, with attention to how a human listener's gender impacts how they perceive deepfakes generally: Cochran and Napshin (2021), for example, found that "women were more likely to have felt deceived by deepfakes." However, research on how a deepfake voice's gender impacts listeners' perceptions remains scarce. Social gender identity is an important part of how we perceive and process language; this fact remains true whether that language comes from a deepfake or a real human voice.

More broadly, gender bias is a problem that must be confronted in the realm of deepfake detection. Nadimpalli and Rattani (2023) found that models trained to detect facial forgery deepfakes can be biased to work more effectively on male faces over female faces if they are not trained on a gender-balanced dataset. Extending this finding to automatic methods of detecting AI-generated speech—rather than AI-generated faces—demonstrates the importance of utilizing gender-balanced audio datasets to train fake speech detectors. With respect to gender bias in voice spoofing, Bilika et al. (2024) tested the efficacy of voice cloning attacks on voice assistants in Android and Apple smartphones, finding that attacks on iOS devices were significantly less likely to succeed for female voices. Given this, it could be the case that other automatic speaker recognition systems are similarly biased, and it remains unstudied whether human listeners have similar perceptual biases along gender lines.

LANGUAGE VARIATION AND LINGUISTIC DIVERSITY

Little attention has been given to the effects of dialect and language background on deepfake discernment and detection accuracy, both by human listeners and automatic detectors. According to Almutairi and Elgibreen (2022), attention to language variation is "still missing from the [audio deepfake] literature, and it is presently unclear whether accents can affect detection accuracy." Furthermore, non-standard language varieties present a challenge to Automatic Speech Recognition (ASR) technology (Najafian, 2013; Metz, 2020). As ASR systems, and speech technologies in general, play an increasingly important role in our daily lives, they must be able to accurately understand and respond to accents and language variation. For this reason, bringing (socio)linguistics into the development of speech technology is a clear need and opportunity. In a related vein, research on how accents

may influence human perception and automatic detection of AI-generated voices is also in need of expansion. In addition to the lack of attention to accented speech in audio deepfake detection research, languages other than English remain underrepresented in the existing literature (Obinali, 2019; Almutairi and Elgibreen, 2022). In fact, in August 2023, researchers at University College London investigated listener deepfake discernment accuracy in English and Mandarin Chinese by bilingual participants fluent in both languages, becoming the first to publish work assessing human listeners' ability to detect AI-generated speech in a language other than English (Mai et al., 2023; UCL, 2023). Finally, language background and proficiency may have a compounding effect on individual abilities to discern fake speech. Müller et al. (2022) investigated listener perception via an online game simulation in which participants competed with an algorithm to detect audio deepfakes. Of the international group of 410 study participants, 79 were native speakers of English, and 331 were native speakers of other languages. Findings revealed that native speakers of English and younger participants showed higher success than non-native speakers and older participants. This finding—native speakers had an advantage in detecting fake audio—highlights a potential need for solutions that are tailored to the needs of non-native speakers.

EDUCATION

A third significant area of needed research on detecting audio deepfakes is in the realm of educational programs designed to counter misinformation by empowering individuals to better identify AI-generated content. Many approaches to countering mis- and disinformation exist: common educational approaches include digital literacy programs, both in the classroom and for the general public. Iacobucci et al. (2021) found that knowledge of deepfakes acquired from participating in digital literacy programs leads people to be less likely to spread and share deepfakes online. This suggests a promising avenue for limiting the virality of deepfakes, which is a core part of their efficacy as vehicles for disinformation, yet it does not necessarily provide a pathway for improving individuals' ability to spot this type of content. Furthermore, Mai et al. (2023) attempted to increase listeners' awareness of audio deepfakes in both English and Mandarin through informational training that familiarized participants with the topic of audio deepfakes. These training exercises improved listeners' discernment ability, but only to a small extent, for both languages. Thus, information priming and digital literacy programs, while valuable in combating mis- and disinformation, do not necessarily improve individual abilities to spot AI-generated content. Public-facing instructional

aids that do attempt to teach individuals how to catch deepfakes rarely focus on listening for auditory cues for fake speech, instead providing visual indicators of AI-generated video content: "Pay attention to blinking. Does the person blink enough or too much?" (MIT Media Lab, 2023). Iacobucci et al. (2021:199) refer to such training programs as providing trainees with "inoculation strategies" which help protect them from the risk of being deceived by manipulated content. At the same time, the authors call for the development of more robust inoculation strategies to equip individuals with tools to help them identify deepfakes, and linguistics provides a valuable body of expertise to incorporate into such inoculation efforts. Training programs and curricula that harness the human capacity for perceiving variation in speech to train listeners to better identify AI-generated speech are thus a novel pathway for improving listeners' deepfake discernment abilities and, based on preliminary evidence, show very promising potential. For example, Mallinson et al. (2024) carried out a pilot study with undergraduate students to determine whether training that familiarizes listeners with English language variation can improve their abilities to discern audio deepfakes. A faculty member and a doctoral student with backgrounds in variationist sociolinguistics listened to hundreds of samples of fake and real speech and identified five features that are both easily discernible to a human listener and helpful in distinguishing fake speech. They include pitch, pause, breath, word-initial and word-final stop consonant bursts, and breath. These features, when incorporated into algorithmic detectors, improved detection accuracy. A short training introducing these features was given to undergraduate students, and preliminary results show that the training improved students' ability to identify fake audio. Thus, trainings and educational programs that incorporate socio-variationist and perceptual linguistic principles to improve listeners' ability to differentiate real from fake speech present a huge potential application of linguistics in classrooms and the public sphere.

CONCLUSION

Linguists, armed with expertise in language variation, speech perception, and more, are uniquely positioned to contribute to ongoing efforts to address challenges that audio deepfakes present. As new applications of AI and language technology emerge, a potential for these innovations to be used for malicious purposes also arises, and with them, pervasive societal challenges. To combat these emerging and ever-evolving threats to individuals and institutions, it is essential to use every research tool at our disposal, which motivates collaboration across academic disciplines to further our collective

knowledge in these areas. This paper presents the case for linguists to play a greater role in transdisciplinary efforts to find pathways to improve our ability to detect deepfakes and mitigate threats to information integrity at the intersection of technology, language, behavior, and society.

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08

Immigrant Attitudes Toward Women's Political Participation in Maryland

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BIOGRAPHY

Riya Patel graduated from UMBC in May 2023 with a bachelor's degree in Political Science and a minor in Economics. In addition to this, she also earned the Honor's College Certificate and completed the Security Studies Certificate. She currently works as the Chief of Staff to a Maryland State Delegate. In the future, she hopes to earn to earn a Ph.D. in Public Policy and work on women's issues. This study was funded by the UMBC Undergraduate Research Award.

Riya would also like to thank her faculty mentor, Dr. Felipe Filomeno, who's guidance and support was critical to the success of her research. She would also like to thank URCAD and Pi Sigma Alpha for allowing her to present her findings to a broader audience at each respective conference.

RESEARCH JOURNEY

My passion for increasing the voice and role of women and underrepresented minorities has been developing since the first government class I took in high school. I noticed the dynamic of how the male students were more vocal compared to the female students about political issues. This trend carried through almost every Political Science class I took. This observation, coupled with my background as a first-generation immigrant and witnessing sexism in my own community, led me to ask what factors influenced the attitudes of immigrants toward women in politics. After taking *Research Methods in Political Science*, my interest in conducting a research study was heightened. I reached out to Dr. Filomeno who liked my proposal and was enthusiastic about mentoring me for this study. With his help, I was able to learn more about a topic that I have been interested in for years and was able to find significant and relevant results that furthered my passion for the subject.

ABSTRACT

Acculturation theory states that immigrants usually maintain some beliefs and values from their homeland during their adaptation process in a new country. Based on this theory, it is plausible that immigrants will hold onto the attitudes toward women typical of their home countries when developing their attitudes toward women's participation in politics in the United States. Few studies have specifically examined attitudes toward women in politics across multiple groups of immigrants. This study investigates how homeland views on gender roles might influence the perceptions immigrants have toward women involved in the political process in the United States. The study used a survey applied to 163 immigrant adults from multiple counties in Maryland. After conducting difference of means tests, single variable linear regressions, and multivariate regressions, this study finds that while homeland gender attitudes had an impact on immigrant attitudes toward women in politics in the US, other demographic variables wield greater influence on these perceptions. Specifically, the study found that gender, political orientation, and age were strong predictors of immigrant attitudes toward women in politics in the United States.

Keywords: Immigrant attitudes, acculturation, gender, politics, women

INTRODUCTION

According to the Pew Research Center, the United States admits over one million legal immigrants each year (Budiman 2020). From 2000 to 2020, over ten million adult immigrants have become eligible to vote (Budiman et al. 2020). Immigrant attitudes toward women in politics are therefore relevant to the success of women in American politics in general and, more specifically, to the political engagement of immigrant women. Knowledge of immigrant attitudes toward women in politics can also assist organizations advocating for women to target particular groups of immigrants when promoting greater women's participation, through voting, running for office, advocacy, and other forms of political participation. This, in turn, can influence the policies that are created and the progress the U.S. makes in women's rights and participation in government. The present study investigates *how homeland views on gender roles might influence the perceptions immigrants have towards women in politics in the United States.*

Attitudes toward gender roles are beliefs or opinions about social roles based on sex that influence the surrounding societal environment (Anderson and Johnson 2003). These beliefs can influence how individuals view women's role in politics, concerning both their participation in political office and women's engagement in politics (as voters, volunteers, activists, etc.). In order to investigate attitudes toward women's participation in politics, this study applied a survey to a sample of immigrants residing in the state of Maryland (United States). Using data from the survey and indicators of homeland gender attitudes, the study runs statistical tests and regression analyses to verify the plausibility of hypotheses about the relationship between homeland gender attitudes and attitudes toward women in politics in the United States. The study finds that immigrants from countries with more traditional or patriarchal attitudes towards women are more likely to hold negative attitudes toward women's participation in politics in the United States. Control variables like gender, political orientation, and age also appear to influence immigrant attitudes toward women in politics.

The outline of the paper is as follows: I begin with a literature review and theoretical framework about the various factors that can influence immigrant attitudes on social issues like women's rights and applying the theories of acculturation to politics. Based on these theories, I formulate hypotheses about immigrant attitudes toward women in politics. In the next section, I describe the methods I utilized to collect the survey data. In the results section, I present the results of the statistical tests and regression analyses. I conclude with a discussion about the findings, policy implications, potential limitations, and avenues for future research.

THEORETICAL FRAMEWORK

Rather than quickly and completely assimilating into the mainstream culture of the United States, many immigrants navigate through the process of acculturation. In general, acculturation can be defined as the adaptation process that immigrants go through as they adopt some ideas, values, beliefs, and behaviors of the host country's culture and usually retain some aspects of their culture of origin (Cavdar et al. 2021). Based on the immigrant's country of origin, it seems likely that immigrants will arrive with varying views on women's political participation. When immigrants come to the United States, it can be challenging for them to navigate the various attitudes and beliefs that may contradict their own. In fact, many theories of socialization propose that the attitudes held by individuals are shaped during the early years of their lives and their basic values are usually fixed by the time of adulthood (Norris and Inglehart 2001). In spite of acculturation, immigrants are able to maintain their own values from what they were taught and the culture they were raised in within their home countries.

Studies about the influence of attitudes toward women on women's political participation generally agree that egalitarian attitudes toward women are an important condition for increasing women's representation in government (Enrile and Agbayani 2007; Norris and Inglehart 2001). Egalitarian attitudes are rooted in the notion of ensuring social, political, and economic equality among all people (Enrile and Agbayani 2007). Because attitudes toward women vary across countries, when people from other countries migrate to the United States, their perceptions about women can influence their attitudes towards women's involvement in politics in the U.S. Although some studies find that voters may prefer female candidates over male candidates (Clayton et al. 2020), they acknowledge the overall disadvantage women have in terms of their ability to run for office and the discriminatory standards voters hold them against (Bauer 2020; Clayton et al. 2020; Dahl and Nyrup 2021; Ono and Yamada 2020).

The attitudes in the country of origin can influence the attitudes immigrants hold toward women after they migrate to another country. For example, a study reported the Indian American immigrant population in the United States has more traditional gender attitudes compared to natives, along with men having more traditional attitudes than women (Tummala-Narra et al. 2017). Indian Americans in other Western nations such as the U.K. showed similar patterns (Hill and Marshall 2018). Similarly, Filipino immigrant males had more conservative attitudes toward women compared to Filipino women in the United States (Enrile and Agbayani 2007). Pakistani

immigrants in the United States also had males with more conservative attitudes than women (Khalid and Frieze 2004). This does not mean that immigrant women do not hold traditional gender attitudes. Overall, immigrating from a country with lower levels of female empowerment and gender equality compared to the host country is associated with more traditional attitudes toward women for immigrants, yet this association appears to be stronger in males (Röder 2014). Dauletova et al. (2022) find that male immigrants show an increased level of bias against women's political participation.

Women's political representation and participation vary across countries. This is predominantly the result of many roadblocks on both the supply and demand side, where women are discouraged from running for office because of the obstacles they might face (Dahl and Nyrup 2021; Norris and Inglehart 2001). For example, 98.4% of female respondents in a study conducted in the Osun State of Nigeria agreed that culture impedes women's involvement in political issues (Abiola 2019). Furthermore, patriarchal cultural stereotypes and socioeconomic influences, like a majority of women living below the poverty line, prevent women in Nigeria from being able to play on the same field as men (Chitongo and Temitope Ojogiwa 2021). In Japan, women tend to self-select out of politics due to socially mandated gender and family roles (Kage et al. 2019; Takao 2017).

While supply-side factors like institutional barriers and access to resources undoubtedly impact women's political involvement, attitudes and societal perceptions regarding women's roles in governance also wield substantial influence. The demand side, encompassing public support for women candidates and the societal acceptance of women's active political engagement, intertwines with the supply side, particularly regarding familial and communal encouragement crucial for aspiring female politicians (Abiola 2019). Thus, a comprehensive understanding of women's political participation requires a holistic consideration of both supply-side constraints and the nuanced dynamics of societal attitudes and demands shaping women's roles in the political sphere.

It is also important to note the difference between traditional versus egalitarian attitudes. In the Western world, there has been a noteworthy shift towards egalitarianism whereas traditional gender roles can be a barrier to women's integration into educational and labor systems. Following this proposition, it is plausible that traditional gender roles would also serve as a barrier to women's integration into politics. Of course, this does not mean that problems associated with double standards and issue competency or specialization have been outright erased from the United States. In fact,

there is still much debate on the topic of gender equality in politics, not only in representation but also concerning beliefs on participation in general. Oftentimes, the public may view male candidates as being better suited to handling different social and political issues than women (Ono and Yamada 2020). Nonetheless, there is no doubt that the United States has more gender equality than some parts of the world and less than other parts.

The present study builds on this literature by investigating immigrant attitudes toward women in politics in the state of Maryland. Many prior studies have been conducted in other areas of the United States and Western Europe, focusing on one or two particular groups of immigrants. Limited research exists that comparatively analyzes how multiple groups of immigrants' beliefs vary based on their country of origin. Even less is known about immigrant attitudes toward women in politics since the attitudes immigrants have toward women's political participation have not been studied as extensively as general immigrant attitudes toward egalitarianism. The present study addresses this gap in the literature by examining the factors, especially their homeland culture, contributing to the attitudes immigrants hold toward women's participation in politics in the United States. In line with prior research, this paper expects to find a positive correlation between the gender attitudes in the immigrants' country of origin and the attitudes they hold towards the role of women in politics in the United States.

HYPOTHESES

Based on the above literature, this study presents the following hypothesis:

> *Immigrants from countries with egalitarian attitudes towards women will be more likely to hold egalitarian attitudes towards the role of women in politics in the U.S. than immigrants from countries with traditional attitudes towards women.*

There are other explanatory variables besides the attitudes towards women in the country of origin that could explain potential variation in the dependent variable. These include gender, level of educational attainment, length of stay in the U.S., political orientation, the immigrant's location of residence in the U.S. (urban, rural, or suburban), religion, and age. This study controls for these variables.

METHODS

In order to investigate the attitudes immigrants have towards women in politics in the United States, I designed a short survey. The first part of the survey asked respondents for demographic information in order to control for factors such as gender, length of stay in the U.S., political orientation, and age. The second part of the survey asked respondents to read nine statements carefully and indicate whether they strongly agree with the statement, agree, disagree, strongly disagree, or are neutral about the statement. Most of these statements mimicked the Attitudes Towards Women Scale created by Spence and Helmreich (1972), altering the wording to specify attitudes towards women in politics. The remaining statements came from a Pew Research Center study about women and leadership (Horowitz et al. 2018). Although the survey consisted of nine statements, only seven of them were used when conducting the statistical analysis because the inclusion of the remaining two statements was found to potentially introduce distraction from the dependent variable.

I sent out the survey via email to 38 local government agencies and local organizations of civil society in Maryland with a flyer inviting immigrants to partake in the study. I selected local government agencies and local organizations of the civil society to reflect the demographic composition of the foreign-born population of Maryland (in terms of national origin) and to include a variety of organizations (religious congregations, ethnic associations, college student clubs, etc.).

To diminish language barriers and ensure that participants would accurately answer the survey questions, the survey was translated into various languages with the assistance of native speakers. The survey was available to respondents in English, Hindi, Arabic, Spanish, and Korean. The survey was conducted through the Google Forms online platform. All responses were anonymous and kept confidential. The survey was open for responses from August 31, 2022, to October 10, 2022.

The dependent variable in this paper is the attitudes of immigrants toward women in politics in the United States. The independent variable is the gender attitudes in the country of origin of immigrants.

Table 1 shows the measurements of the variables. It identifies the seven statements in the survey as indicators for the concept of attitudes toward women in politics in the United States. The dependent variable utilized an ordinal measurement with the Likert Scale to test how immigrants perceived women's participation in politics. The indicator was combined into an index in order to statistically analyze the survey data. Doing so allows for a greater range of responses for participants. Furthermore, each statement on

the questionnaire was carefully analyzed to reduce the social desirability bias as much as possible. Participants were asked to answer the survey as accurately and honestly as possible along with ensuring the anonymity of their responses. Additionally, having a "neutral" option on the survey prevents participants from lying on the survey if they think they have views that are unacceptable.

In order to generate an index value, I created a Microsoft Excel spreadsheet and input the data from the survey. I assigned a value between 1 - 5 to the Likert scale answers for questions where strongly disagree to strongly agree means the most feminist response to the most patriarchal response. For questions where strongly disagree to strongly agree meant from the most feminist response to the most patriarchal response, I assigned negative values from -1 - -5. Then, for each participant, I summed the values for each of the seven responses, generating a value for the index of patriarchal views. The most feminist value for this was 1 and the most patriarchal value was 24. This was later converted into a 1-10 scale, 1 being the most feminist and 10 being the most patriarchal. This number gave an overall sense of the attitudes the participant holds toward women in politics. I also created two additional index values that provide more specific information about every participant's attitude toward women in politics. Each question in the survey measures one of three main themes related to women in politics. The first is the statements that measure attitudes toward increasing women's participation in politics (Questions 1, 5, and 7). The second group of statements measures the attitudes regarding the comparison between men and women in politics (Questions 2, 3, 4, and 6).

There is no valid indicator that has measured cultural attitudes toward women in each country. Due to this, I used a proxy variable provided by The World Economic Forum. The World Economic Forum releases an annual Gender Gap Report providing gender statistics for each country around the world. One of the statistics reported is the Global Gender Gap Index, which assigns nations a value between 0 and 1. A lower value indicates less gender equality, and a higher value is associated with greater gender equality. This statistic shows general gender attitudes and equality in a nation. It considers economic factors like participation in the labor force but also factors like leadership positions, family care, civil and political freedoms, health, and many others. I am using this indicator as a proxy because it is likely that egalitarian attitudes towards when are positively correlated with a higher value on the Global Gender Gap Index. This measure is reliable as it was published by a reputable source.

Concept	Indicator	Type of Variable
DV: Attitudes Towards Women in Politics in the United States	Index values created from the following statements: 1. Women should take increasing responsibility for leadership in solving the social problems of the day. 2. Women having to do more to prove themselves than men is a major reason why there aren't more women in high political offices. 3. When it comes to the leadership styles of people in top positions in politics, men generally have a better approach compared to women. 4. It is easier for men to get elected to high political offices than women. 5. Young girls should be encouraged to pursue political leadership positions. 6. Gender discrimination is a major reason why there aren't more women in high political offices. 7. The United States would be better off with more female leaders.	Ordinal Measurement: Value between 1 - 10 for a combined index Value between 1 - 10 for attitudes toward increasing women's participation in politics Value between 1 - 10 for attitudes regarding the comparison between men and women in politics
IV: Gender Attitudes in the Country of Origin	Global Gender Gap Index – World Economic Forum Gender Gap Report (2022)	Interval measurement: Numerical value from 0-1 Converted to Ordinal Measurement between 1 - 10
IV: Control Variables	Responses on survey questionnaire asking for Gender, Age, Education level, Length of stay in the U.S., Urban/rural residence in the U.S., Religion, and Political orientation	Gender - Nominal Age - Ratio Educational level - Nominal Length of Stay in the US - Ordinal Urban/Rural Residence - Nominal Religion - Nominal Political Orientation - Nominal

TABLE 1:
Measurement

RESULTS

DESCRIPTIVE STATISTICS

The survey yielded a sample of 163 immigrant adults. The following table shows the frequency distribution of the control variables that provide information regarding the demographics of the sample.

Q1: Gender	
Male	39.9%
Female	59.5%
Other	0.6%
Q2: Age	
18-28 years	32.5%
29-38 years	12.9%
39-48 years	17.8%
49-58 years	25.8%
59+ years	11.0%
Mean	40.6 years
Q3: Educational Attainment	
Less than high school	0%
High school diploma/GED	12.3%
Some college	27.6%
2-year college degree	8.0%
4-year college degree	30.7%
Master's degree	16.0%
Doctorate (Ph.D.)	4.3%
Professional doctorate (JD/MD)	1.2%
Q4: Religious Affiliation	
Not religious	17.2%
Christian	52.8%
Muslim	10.4%
Jewish	1.2%
Hindu	16.6%
Other	1.8%
Q5: Political Orientation	
Conservative	6.1%
Moderately Conservative	12.9%

TABLE 2:
Descriptive Statistics

Moderate	38.0%
Moderately Liberal	19.6%
Liberal	21.5%
Other	1.8%
Q6: Urban Rural Residency	
Urban	23.9%
Suburban	62.0%
Rural	13.5%
Other	0.6%
Q7: Length of Stay in the US	
1-5 years	16.0%
6-10 years	12.9%
11-15 years	15.3%
16-20 years	22.1%
21-25 years	15.3%
26-30 years	4.9%
31+ years	13.5%
Mean	17.8 years
Q8: Country of Origin	
From Europe	8.0%
From Latin America	30.7%
From Asia	38.0%
From Africa	21.5%
From Northern America	1.2%
From Oceania	0.6%

TABLE 2:
Descriptive Statistics (Continued)

Referring to the data from the Migration Policy Institute (2022) that states in 2019, about 8.4% of immigrants in Maryland were from Europe, 39.6% were from Latin America, 32.3% were from Asia, 18.5% were from Africa, 0.9% were from North America, and 0.4% were from Oceania I categorized the country of origin for each participant according to each of the aforementioned regions (Table 2). The 163 respondents were from 42 different countries.

Overall, the sample in this survey was roughly similar to the foreign-born population of Maryland in 2019 in terms of region of origin. The only notable difference is that in the 2019 data Latin American immigrants made up the largest percentage of immigrants in Maryland and Asian immigrants were the second largest. In the current study, this is reversed. Immigrants from Asia make up the largest percentage whereas Latin American immigrants are the second largest group. Both groups have a roughly similar percentage in both sets of data, and so it is not an extreme difference that would dramatically bias the results of this study. This sample is roughly approximate to the population but not quite representative as the countries immigrants are migrating from may not be exactly distributed similarly.

DIFFERENCE OF MEANS TEST

To test the difference of means based on the country of origin for the immigrants, I combined the data based on the respective region of each country, in accordance with the 2019 Migration Policy Institute report on Maryland immigrants (Table 3). The three largest groups were Asia, Latin America, and Africa. I conducted three sets of difference of means tests to examine the relationship between these three groups with each other. The first set of t-tests conducted was for Latin American immigrants against Asian immigrants. The t-value for the combined index was -2.524 and was statistically significant at the 0.05 level. Asian immigrants had slightly more patriarchal values towards women in politics than Latin American immigrants. The next difference of means test I conducted was to compare Asian immigrants to African Immigrants. The combined index t-value was 1.988 and was statistically significant at the 0.05 level. The increasing participation index with a t-value of 2.178 was also statistically significant at $p < 0.05$. The final set of difference of means tests tested the index values of African immigrants against the index values of Latin American immigrants. None of the t-values for this difference of means test were statistically significant.

Q8	**Combined Index Average**	**Increasing Participation Index Average**	**Men vs. Women Index Average**
Europe (n=13)	4.019	3.481	3.683
Latin America (n=50)	3.715	2.830	3.543
Asia (n=62)	4.391	3.359	4.601
Africa (n=35)	3.764	2.629	3.732
Northern America (n=2)	3.250	2.125	2.969
Oceania (n=1)	1	1	1
Latin America vs. Asia t-value	-2.524*	-1.903	-2.452*
Asia vs. Africa t-value	1.988*	2.178*	1.738
Africa vs. Latin America t-value	0.147	-0.567	0.361

*$p < 0.05$**

TABLE 3:
Q8 t-test: Country of Origin

SINGLE VARIABLE LINEAR REGRESSION ANALYSIS

The main hypothesis for this study (H1) states: Immigrants from countries with egalitarian attitudes towards women will be more likely to hold egalitarian attitudes towards the role of women in politics in the U.S. than immigrants from countries with traditional attitudes towards women. To test this hypothesis, I tested the dependent variable (attitudes towards women in politics in the United States) against the indicator for the independent variable (gender attitudes in the country of origin).

To find the regression model, I utilized the statistical software, Stata. I began by converting the Gender Gap from its original zero to one scale to a one to 10 scale. This is because the combined index for the attitudes towards women in politics is measured on a one to ten scale. Table 4 presents the results of these regressions. All the results in this table are statistically significant at the $p < 0.05$ level. The general equation used for the single variable linear regression is $Yi = \alpha + \beta xi$ where Yi is the predicted value of the dependent variable (immigrant attitudes towards women in politics in the U.S.) and xi is the value of the independent variable (gender attitudes in the country of origin). The constant, α, is the predicted value of immigrant attitudes towards women in politics in the U.S. when the independent variable

is zero. The unstandardized beta coefficient, β, represents the slope of the line that best describes the relationship between the independent and dependent variables. The sample size for both regressions is n = 163.

The results column in Table 4 shows Model 1, which is the regression testing the Gender Gap Index, which represents the gender attitudes of the country of origin (IV), against the Combined Index, which represents the attitudes towards women in politics in the U.S. (DV). The regression equation for this test can be rewritten with the data as: Attitudes towards women in politics in the U.S.i = 8.300 - 0.622 (gender attitudes in the country of origin). The unstandardized beta coefficient, β, is -0.622 and it is statistically significant at $p < 0.05$. This means that for each unit increase in the patriarchal gender attitudes of the country of origin as measured by the Gender Gap Index, the attitudes towards women in politics in the U.S. as represented by the Combined Index fall by 0.9565 points on the one to 10 scale of measurement. It is important to note that the Combined Index is measured inversely compared to the Gender Gap Index. This means that a higher value in the Combined Index means the immigrant holds more patriarchal values whereas a higher value on the Gender Gap Index means the country has greater egalitarianism regarding gender. Because of this, there is a relatively strong negative correlation between both indexes. Since both indexes are measured on a one to 10 scale, a decline of 0.9565 is relatively large. Though, this value explains the line of best fit and there are other outlying data present.

The constant for Model 1 is 8.300. This means that when the Gender Gap Index is at zero, indicating no gender equality in a country, the Combined Index value is at 8.300. A value of 8.300 is on the high end of the one to 10 scale, and a value of 10 on the Combined Index scale suggests that the immigrant has the most patriarchal views towards women in politics. The standard error for the slope coefficient is 0.1665 suggesting that this regression model estimates the coefficient's value for the population (immigrants in Maryland) fairly accurately as it is a small value. The adjusted2 value is 0.074. This means that 7.4% of the variation in the attitudes towards women in politics in the U.S. can be explained by the Gender Gap Index. This is a large portion of the many variables that could explain attitudes toward women in politics. The slope coefficient of -0.622 is statistically significant, so, based on this regression model, the null hypothesis, stating that there is no relationship between the gender attitudes in the immigrants' country of origin and the attitudes they hold towards the role of women in politics in the U.S., can be rejected.

Independent Variable Indicators	Model 1 (Std. Error)
Gender Gap Index	- 0.6220* (0.1665)
Constant	8.300* (1.1594)
N	163
Adj.	0.0740

*p < 0.05**

TABLE 4:
Single Variable Linear Regression

MULTIVARIATE REGRESSION ANALYSIS

To control for the explanatory variables, I conducted a multivariate regression assessment when testing the independent variable against the dependent variable. For this analysis, religious affiliation was excluded as there was a lack of statistical significance in a difference of means test. I converted educational attainment into a binary variable indicating those who had obtained a college degree and those who had not. I also converted urban/rural residence into a binary variable based on whether the participant lived in a rural area or not.

The general multivariate regression equation is as follows: $Yi = \alpha + (\beta * xi)1 + (\beta * xi)2 + \ldots(\beta * xi)n$. The result of the multivariate regression is shown in Table 5. For this multivariate regression analysis, I assessed the correlation between the Gender Gap Index with the Combined Index values while accounting for gender, age, educational attainment, political orientation, urban/rural residency, and the immigrant's length of stay in the United States. Controlling for each of these variables, each additional unit increase in the Gender Gap Index is associated with a 0.1494-point decrease in the Combined Index. Because both indexes are measured on a scale of 1-10, this is not a considerable decline compared to the single variable regression that had a coefficient statistic of -0.6220. This value is not statistically significant at the $p < 0.05$ level of significance because the p-value is 0.2370. The standard error for the coefficient of -0.1494 is 0.1258, which is smaller than the standard error for the single variable regression coefficient. This means that this regression model estimates the coefficient's value for the population (immigrant adults in Maryland) fairly accurately. When other variables are considered, the relationship between the Combined Index and the Gender Gap index weakens and loses statistical significance. However, this could be due to the Gender Gap index being a proxy variable for gender attitudes in a country, and results may differ with a more accurate indicator.

Other variables have higher coefficients than the Gender Gap Index such as political orientation, educational attainment, and gender. These values are statistically significant and are in line with their respective hypotheses. For educational attainment, controlling for the other variables, each additional unit increase in educational attainment (moving from no degree to holding at least one degree) is associated with a 0.4257-point decrease in the Combined Index, meaning the participant is holding more feminist attitudes. Similarly, controlling for the other variables, each additional unit increase in political orientation (moving on a scale of 1-5 from conservative to liberal) is associated with a 0.4657 unit decrease in the Combined Index. This means that as one becomes more liberal, they are more likely to hold feminist views towards women in politics. In terms of gender, the value of one was assigned to male, and two was assigned to female. This means that moving from male to female, the value on the combined index fell by 1.1345, indicating that women are more likely to hold feminist views toward women in politics compared to men. The only value that did not hold statistical significance at 0.05 but was statistically significant at 0.10, was the urban/rural residency variable. This could be due to the conversion into a binary variable that may have distorted the results. The adjusted2 for this regression model was 0.5700 which means that all of these variables combined explain about 57% of the variance in the views held by immigrants concerning women's participation in politics.

Independent Variables	**Model 3 (Std. Error)**
Gender Gap Index	-0.1494 (0.1257)
Gender	-1.1345* (0.1641)
Age	0.0194* (0.0062)
Educational Attainment	-0.4257* (0.1643)
Political Orientation	-0.4657* (0.0771)
Urban/Rural Residency	0.3443 (0.1755)
Length of Stay in the U.S.	-0.0248* (0.0078)
Constant	8.3025* (0.9952)
N	163
Adj.	0.5700

*$p < 0.05$**

TABLE 5:
Multivariate Regression: Gender Gap Index

Based on these results, each of the variables appears to have some level of influence on immigrants' attitudes toward women in politics. In order to determine the variables with the strongest influence, while accounting for all of the other variables as well, I conducted five more regression analyses to test how much the Adjusted2 value increases with the addition of each variable. Because there was a lack of statistical significance for the urban/rural divide and the Gender Gap Index in the multivariate regression (Table 5), I did not take the urban/rural residency variable and the Gender Gap index into consideration.

I began by testing how much gender influences immigrant attitudes toward women in politics with consideration for all other variables. To do this, I ran a multivariate regression with the Combined Index along with all other variables except for gender. I noted the Adjusted2 value and then ran the regression again with gender as the last added variable. I noted the Adjusted2 value again and found the difference between both. This change in the Adjusted2 indicates how much of the variance in the dependent variable is associated with a change in the independent variable. This method can be used for a multivariate regression analysis to identify which of the independent variables has the greatest influence on the dependent variable. I used this method to test gender, age, educational attainment, political orientation, and length of stay in the U.S. which represents the attitudes toward women in the immigrant's home countries as the independent variables being analyzed. Table 6 shows the results of these tests.

Variable	Adj. without variable	Adj. with variable	Difference in Adj.
Gender	0.4380	0.5688	0.1308
Age	0.5397	0.5688	0.0291
Educational Attainment	0.5531	0.5688	0.0157
Political Orientation	0.4606	0.5688	0.1082
Length of Stay in the U.S.	0.5458	0.5688	0.0230

TABLE 6:
Influence of Each Variable

According to these findings, the order of influence from most influential to least is as follows: gender, political orientation, age, length of stay in the U.S., and educational attainment. The Adjusted2 with all of these variables was 0.5688. By finding the changes in the Adjusted2 I was able to rank each variable based on how important of an indicator it was for the change in the dependent variable. About 13.08% of the variation in the immigrant attitudes toward women in politics can be explained by the gender of the participant. Based on prior difference of means test results, women were more likely than men to hold feminist attitudes toward women in politics. Gender explains the largest portion of the variation in the dependent variable. Political orientation had the second largest change in the Adjusted2 . About 10.82% of the variation in immigrant attitudes toward women in politics can be explained by political orientation. The variable with the third largest change in the Adjusted2 was age. Age can explain about 2.91% of the variation in immigrant attitudes toward women in politics for this sample.

The remaining three variables can explain between 1-3% of the variation in the dependent variable, which is not a significantly large amount. Length of stay in the U.S. accounts for about 2.30% of the variation in the dependent variable and educational attainment accounts for about 1.57%. Overall, gender, political orientation, and age seem to be the three largest variables that explain variation in the dependent variable.

DISCUSSION AND CONCLUSION

In this study, a correlation was found between gender attitudes in the country of origin and immigrant attitudes toward women in politics in the United States. The relationship between these variables was initially strong, according to single-variable linear regression. However, when accounting for other variables such as gender, age, educational attainment, political orientation, urban/rural residency, and length of stay in the United States, this relationship weakened, losing statistical significance, as well. Previous studies also support the finding that egalitarian or traditional attitudes in their home countries predict immigrants' views on women's role in politics. Surprisingly, the influence of gender attitudes in the country of origin diminished when controlling for other variables. Future research could explore the relationships between gender, political orientation, and age on immigrant attitudes through qualitative studies in addition to using a different proxy variable to describe gender attitudes in the country of origin.

The influence of gender was found to be significant, with women more likely than men to hold egalitarian attitudes toward women in politics. These

findings align with prior research. Women were more likely to hold significantly more feminist views, suggesting that they are more aware of the barriers and disparities in political participation between genders. Age was another important variable, with younger participants more likely to hold egalitarian views. Political orientation also strongly influenced immigrant attitudes toward women in politics, as political parties in the United States are often associated with social issues like women's rights. Other variables, although statistically significant, did not exhibit as strong a relationship with immigrant attitudes toward women in politics. Religious affiliation did not have enough representation for a meaningful relationship, and the variable for educational attainment lacked participants with lower or higher levels of education. Nevertheless, education seemed to play a role when converted to a binary variable. The length of stay in the United States did not emerge as the most significant variable, and urban/rural residency lost its significance in the multivariate regression due to sample size limitations.

The study's aim was to explore the connection between attitudes toward women in immigrants' countries of origin and their attitudes toward women in U.S. politics. This study found evidence to support the hypothesis that immigrants from countries with egalitarian attitudes toward women are more likely to hold egalitarian views on women's role in U.S. politics compared to immigrants from countries with traditional attitudes. This rejection of the null hypothesis in favor of the alternative hypothesis was statistically significant based on the single variable regression. However, based on the multivariate regressions, I was unable to reject the null hypothesis because when accounting for the other demographic variables, the Gender Gap Index lost statistical significance. Although there appears to still be a relationship, these findings should be taken with a degree of skepticism.

These findings have policy implications for organizations and individuals aiming to increase women's political participation. By targeting specific segments of the immigrant population based on their goals, such as NGOs, candidates, or community groups, they can tailor their efforts. For example, organizations promoting women's political participation can focus on immigrants from countries with traditional values toward women. The study also suggests that gender attitudes in the country of origin influence immigrant values, with Asian immigrants showing more traditional attitudes compared to Latin American or African immigrants. Furthermore, factors like gender, age, and political orientation play a significant role in shaping immigrant attitudes toward women in politics. Organizations and politicians can use this information to target specific groups for their initiatives. For instance,

they can focus on older, male, and conservative immigrants to promote more egalitarian values or target younger, female, and liberal immigrants for other purposes, such as recruiting immigrant women for political office or electoral campaigns of female candidates.

LIMITATIONS

This study has several limitations. First, the sample only considers immigrants residing in the state of Maryland, which is a relatively progressive state compared to others. Results may be different when considering immigrants in other parts of the United States. Additionally, the immigrant population of Maryland may be different from the immigrant population of the United States as a whole, especially in terms of national origin. This can also result in inconsistent findings in future research outside of Maryland. There was also an insufficient sample size to properly analyze the effect of certain variables like religious affiliation and urban/rural residency. Furthermore, the Gender Gap Index is not an entirely accurate indicator of gender attitudes in the immigrants' countries of origin as it considers other factors unrelated to gender attitudes. Utilizing a more accurate indicator could yield different results. Lastly, the sample was a convenience sample with a large proportion of college students. Future studies should try to create a larger and more age-diverse sample.

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09

Can You Teach Me How to Tutor? An Examination and Suggested Re-centering of UMBC's ENGL 321 Tutoring Course

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BIOGRAPHY

Clair Volkening graduated in May 2023 with a BA in English and a minor in Music. She was a member of the Humanities Scholars Program, the Honors College, and the Sigma Alpha Lambda English Honors Society while at UMBC. In her senior year, she was named a Fulbright Award semi-finalist. Clair would first like to thank Professor Elaine MacDougall, her research advisor and mentor, for her guidance, feedback, and support throughout this project. She would also like to thank Dr. Earl Brooks and Dr. Drew Holladay for their willingness to offer help and their constant encouragement. Finally, she would like to thank Professor Lia Purpura and Professor Sally Shivnan for showing her what is possible with writing and Dr. David Hoffman for helping her imagine the world as it could be and for always digging deep and asking why.

RESEARCH JOURNEY

From the middle of my sophomore year to the end of my junior year, I noticed that all my classes and professors seemed to focus on the idea of people and all their cultural and inherent characteristics being accepted and uplifted. My initial response to this realization was the desire to put all of them in a room together and see what they came up with given their individual focuses on areas like African American rhetoric, disability studies, creative writing, civic engagement work, psychology, etc. This research stemmed directly from that desire and the belief that so many of the humanities disciplines are interconnected. After I started working as a tutor in the Writing Center (WC) at UMBC, I found a place where all of what I had been thinking about came together. The WC is a space that combines all those topics that are generally separated by class and places them in a real-time, high impact space. This research is less about answers or findings and is more about how we as people exist and the role writing can or should play within academia and the world at large.

ABSTRACT

Writing Center tutors often simultaneously take on the roles of tutor, friend, mentor, peer, therapist, cheerleader, and more. There is no set definition or guide for what Writing Center tutors do in each session. In this work, I illustrate the importance of fluidity and the acceptance of the "trickster," which often present in the form of people or moments that bend what is traditionally expected within the tutoring space to help students feel comfortable and find a sense of purpose in their writing. This project engages the conversation around what writing education at the college and university level is meant to help students accomplish and, primarily, how to prepare student Writing Center tutors to work with their peers. As a former Writing Center tutor , I draw upon my own experience in both the UMBC Writing Center and English 321, the tutor training class this project offers a new lens through which to frame.

INTRODUCTION

> *"The academy is not paradise. But learning is a place where paradise can be created." (hooks, Teaching to Transgress 207).*

This statement by bell hooks raises a very important conversation about the role of higher education, the academy, and learning in general. If we can (co-)create paradise through learning, what does that mean for the way that education is structured now and how it needs to change to make that paradise possible? Of course, this is far too big a topic to even attempt to answer, but I would like to trouble the ideas surrounding education at least in a small way. In this paper, I will focus on one class, ENGL 321, which is the class all potential writing tutors for the University of Maryland, Baltimore County's Writing Center have to take to become paid tutors. In particular, I will dissect the course's role in helping tutors discover the "paradise" hooks mentions and suggest how those tutors can expand the reach of that "paradise" to the students they tutor.

Over the past year, I have dived into the world of Writing Center (WC) research and pedagogical practices to re-design the current Writing Tutor class at UMBC (ENGL 321). Before I launch into the research I have done and my ideas for remodeling ENGL 321, I would like to offer a disclaimer: if there is anything that working on this project has taught me, it is that creating and running a class is incredibly difficult. There are a thousand different ways to organize a class and no way to account for how different groups of students will react to different techniques or assignments. Thus, I am not offering this research in any attempt to "fix" the existing ENGL 321 course, which I and my fellow writing tutors took and found very helpful, but to offer a potential new direction for the class to take, or rather, a different lens through which to organize the class.

METHODOLOGIES

For this project, I implemented a variety of research strategies. I conducted a literature review of prominent pedagogical and WC theory, which is outlined early in the paper. I worked with Professor Elaine MacDougall over the summer of 2022 to make a few additions to her syllabus for the fall 2022 ENGL 321 course, which consisted primarily of bringing guest speakers to the class over the semester. Finally, I conducted two Google surveys with two groups of students: the first occurred during spring 2022 and was given to current WC tutors at the time who had taken ENGL 321 anytime between fall 2019 and fall 2021. I received thirteen responses and the questions I asked

in these surveys are included in Appendix A, section 1. The second survey was given to the students enrolled in the fall 2022 ENGL 321 course. I received fifteen responses to this survey and the questions are listed in Appendix A, section 2. For clarification and anonymity purposes, I will be citing all responses from the spring 2022 WC tutor survey as "Writing Center Tutor" and all responses from the fall 2022 ENGL 321 class survey as "Fall 2022 ENGL 321 Student." Before I explain my proposed changes for the ENGL 321 course, I will first provide a brief background of the purpose of Writing Centers and an overview of the literature that informed this project.

WHAT IS A WRITING CENTER?

Perhaps the biggest and most difficult-to-answer question in regard to this project is: *what is a Writing Center?* What role is it meant to fill and for which students is it meant to fill that role? This question has been a huge point of contention in WC literature and in higher education institutions at large and is not a question that I am equipped to answer definitively, as it is a question scholars continue to debate within the WC field.

Ultimately, The WC is not something that can be defined because it is constantly changing and adapting to different student needs and because everyone has a different idea of what the WC is and does. In my own experience as a tutor, I have seen firsthand how different groups of people take different views of the WC. After working within the UMBC WC, I can comfortably say that most of the tutors see it as a place in which we enact anti-racist and anti-ableist practices, attempt to create a space that is welcoming for all, and tailor our approach to tutoring to try and fit each individual student's needs, in addition to our main role in helping students with their writing. However, this is a view that eludes specific definition because we do not *do* anything specific within the WC. Sometimes we help students understand comma usage or work through a rubric with a student to ensure they are adhering to a professor's strict demands regarding a writing assignment. Other times we simply listen as a student explains their frustration towards a certain class, assignment, or writing in general. We move fluidly between the roles of hands-on teacher, collaborator, research partner, listener, peer, and friend.

Beyond what those who work in the WC think of it, it is also extremely important to dissect what groups more distanced from the center see as the center's role. Professors, students, and the broader institution have certain ideas about what the WC is and does, just as the tutors and WC administrators do. These sets of beliefs and ideas are often at odds with each other, which can cause confusion. For instance, in my experience, it appears that

some professors see the WC as a place to send their students to get their paper topic "approved" before submitting it for a grade, some see it as a collaborative space for students to work through their thoughts outside of class, and still others see it as a "fix-it-shop" for students who struggle with using Standard Academic English in their writing. Administration might use the WC as a way to showcase the academic help available to potential students if they attend UMBC and less as a way to help individual students. Because what we do in the WC is so vague and dependent upon each individual student, these misconceptions are difficult to counteract, and the convoluted history of WC's does not make understanding the role of the WC any easier.

THE HISTORY OF THE WRITING CENTER

Writing Centers were first instituted in higher education in the early twentieth century and were called "Writing Labs." These "labs" were very different from the modern conception of a WC on college campuses today. Instead of being a place of tutoring, a writing lab described a way of teaching used by writing instructors at a college. The professor would schedule time for students to write and would correct their students' writing while they wrote. While the instructor watched, "students labored, afforded the opportunity first to self-correct errors in drafts and, failing that, to have their papers corrected immediately, line by line, by the instructor himself, thereby encouraging the internalization of discursive norms (Boquet 467). Thus, writing was seen as an endeavor in which students needed to be "fixed" and taught how to do it "correctly."

Between the 1920s and 1940s, Writing Centers became less a method of instruction and instead more a concrete place. During this time, there seems to have been a disconnect between the dialogue-centered, student- first approach that would hopefully enable students to become independent thinkers and the idea that true education meant "internalizing organizational patterns and mechanical rules" (467). Later, during WWII, there was an increased attempt to "present information in conservative, current-traditional terms," and the writing labs at the time "focused primarily on the individual rather than the social nature of composing, and individual improvement was often seen as necessary only for remedial students" (468). Thus, the Writing Center was seen as a space meant to serve a certain group of students, in this case, remedial students who might not be writing at department standards, and a student's "failure" to meet the standards of the institution was seen as their personal responsibility. In short, WCs became a disciplinarian space where students were sent when they did not meet expectations, so they could be

taught what it was believed they should have already known.

Around the 1940s, the field of psychology began impacting WCs, and the concept of the Rogerian approach began informing writing tutelage through non-directive tutoring. Non-directive tutoring, like the Rogerian approach to therapy, was based on the idea that tutors were meant to ask questions in order to draw out knowledge that the student assumedly already possessed and just needed to access. This method of tutoring changes two aspects of the WC. First, with its basis in psychological therapy, the non-directive approach situated the center as a space that should feel as secure as a therapist's office, something which set the center apart from the classroom space. Second, through its emphasis on student knowledge, this method provided "yet another means for individual students to be held accountable for their own successes as well as their own shortcomings by making students responsible for accessing information which continually alludes them" (Boquet 470). During this time, the link between remediation and the Writing Center was further solidified.

In the next few decades, WCs and research surrounding WCs all but disappeared. Boquet and other scholars argue that this happened because of the increase in class segregation in higher education. Working-class students (i.e. often the less academically equipped students) began attending community colleges instead of more traditional four-year universities while the wealthier students (i.e. the often more academically equipped) continued to attend the four-year schools. As this change happened, fewer students entered four-year schools in need of remediation, and so remedial spaces like WCs were simply discontinued (Boquet 472). In the 1970s, research surrounding Writing Centers reappeared but seemed unable to address the social issues that were arising. For example, because the segregation of education started when children were young, those who were wealthy, white, and had solid education as a child were more equipped to meet the expectations of higher education institutions while minority and lower-income students were less likely to fit the mold created for those wealthy white students.

From the 1970s on, Writing Centers took on a role that is still familiar today: that of spaces meant to be safe and non-threatening. Scholars began to believe that, since the students using the help centers did not necessarily work well within the traditional classroom structure, WCs should be different from those traditional spaces. Their solution was peer tutoring (Boquet). This marks the beginning of collaborative learning as a big part of Writing Center work and also brings up two very complicated questions. First, how to train tutors to work with their peers, and second, what does the presence

of peer tutors in the WC do to change the role of the WC in the larger institution?

Today, Writing Centers are still evolving and changing as different theories and tutoring practices take hold. One of the prominent concerns of current WCs is that of grammar. Many centers make a point of saying that they refuse to help with grammar and editing because they are meant to help with content and structure. However, this blanket statement of "no grammar help" ignores the possible needs of students and professors. In the WC world, approaches like directive versus non-directive (Rogerian model) tutoring and an emphasis on trying to create a safe space are still prevalent. Difficult questions remain, such as "how much 'work'" is too much 'work' for a tutor to do for a student?" and "how do tutors create that safe environment for free thought for all students when every student has a different idea about what is comfortable and safe?" Many more questions surround the micro-scale behaviors within a tutoring session and macro-scale practices or rules that are embedded within the larger institution.

ENGL 321 AND THE UMBC WRITING CENTER

As mentioned before, one of the biggest questions surrounding WC work is that of how to train peer tutors to work with students. At the University of Maryland, Baltimore County (UMBC) Writing Center, and within ENGL 321, there is an emphasis on community building and meeting students where they are. The UMBC WC website reveals that we help "UMBC students with writing in any class at any stage of the writing process." And, that we "work with students at any stage of the writing process, so you don't even need to bring a rough draft. If you're having trouble getting started, bring us your assignment sheet and spend a few minutes talking about pre-writing strategies with any of our experienced tutors" (academicsuccess.umbc.edu). Concretely, this is exactly what we do. In my sessions as a tutor, I have worked with students who come in with nothing but an assignment sheet, and we have brainstormed topic ideas and strategies to start the writing process. During other sessions, I have worked with students who bring in an already heavily edited final draft who just want a second (or sometimes even third or fourth) pair of eyes to double-check for any typos or other sentence-level issues.

Beyond the actual writing, though, the WC works with real people who enter the space with different needs and different mindsets. Some students

are already confident in their writing and embrace the collaborative environment that the WC so often is. These are folks who see possibility in their writing. Other students come to a session already feeling discouraged or unhappy with their writing. In my experience, the number of people who start their session with the disclaimer, "my writing is bad," is disappointingly large. Just like we approach different writing stages differently, we also have to approach different students differently during the sessions. Thus, a student who comes in and tells me that they hate writing, their professor gave them a bad grade on their last assignment, and they seem unsure how to even go about "correcting" what was "wrong" in their writing, requires a different session then a student who comes in with a paper on a topic they really enjoy, already feels a semblance of self-agency in their writing, and is looking forward to bouncing ideas off a tutor sounding-board. So, beyond what the UMBC WC website says, the WC is a space where tutors *read* students, where they make in-the-moment decisions about what to say and how to say it in order not just to help with a student's writing, but to also to improve a student's sense of self-worth and confidence in their abilities.

ENGL 321

Like the WC, ENGL 321 is very person-centered. Last fall, the first learning objective listed on the course syllabus was, "Demonstrate the value of listening and the attendant qualities of patience, empathy, and respect for our diverse campus community," which was immediately followed by, "Adopt anti-racist tutoring practices and philosophy" and "Gain confidence in your own writing, mentoring, and leadership capacities" (MacDougall 1). Thus, the goal of ENGL 321 is to help future tutors become active, empathetic, and respectful listeners, push back against societal oppressive structures that are embedded within writing and beliefs around writing, and grow as people. Importantly, there is nothing in the course objectives that emphasizes learning how to edit or "correct" writing. Instead, the focus is on a broader approach or way of being that will hopefully enable tutors to become helpful and encouraging sources of knowledge.

Before I move into discussing how I believe this approach could be expanded, I will go over a few of the aspects of ENGL 321 that work particularly well. The first of these are student-led reading presentations on the assigned readings throughout the semester. I observed some of these presentations during the fall 2022 course and was struck by how involved the presenters and the other students were in the material. Each reading presentation was led by a group of two students who were expected to create a PowerPoint

presentation which included discussion questions and activities and took up almost the entirety of the class time. During these presentations, all the students were actively involved and thinking about the reading material and there were many lively discussions as a result. One student in the class wrote that "When everyone gave their reading presentations, and specifically my own, I was able to fully immerse myself into a specific topic and learn why that topic is important in Writing Centers" (Fall 2022 ENGL 321 Student). I believe that the reading presentations also work well because they allow students to see themselves in a different light. As someone who has taught and given presentations before, I know that standing or sitting in front of a class and leading the discussion is powerful. When I was an ENGL 321 student in fall 2021, MacDougall used a different kind of presentation formula (recorded videos on VoiceThread), but she changed the presentations for the fall 2022 class. Having seen both versions, I think that the latest iteration of the reading presentations works significantly better to get students truly involved with the material.

Another piece of ENGL 321 that I would like to highlight is that MacDougall uses labor-based grading contracts instead of traditional grading. She models her grading system on Asao B. Inoue's "Labor-Based Grading Contracts," which argues that the traditional way of grading is firmly situated in white supremacist ideologies and adds to the oppression and unfairness within the education system (Inoue). Ultimately, the concept is that students are graded on the labor they put into the course and not graded on judgments made by the professor. Several 321 students I spoke with, both formally and informally, said they greatly appreciated the labor-based system. Intriguingly, the main point they brought up is that they felt it alleviated the fear of a bad grade and allowed them space to dive into the material and really focus on learning.

Now that I have situated the UMBC WC within the history of WC's in general, I will move into discussing the nature of higher education and classroom spaces, writing and its place in a larger institution, and finally, the importance of community building within and outside of the center.

THE ACADEMIC CLASSROOM AND OUR PLACE IN IT

Traditionally, classroom spaces follow a set of fixed guidelines, and students and teachers are expected to behave according to those guidelines. For instance, teachers are called "Professor" or "Doctor," and they stand or sit in

the front of the room while students sit facing the teacher, wait to be called on, and on and on. Without even really questioning it, we generally adhere to these rules. At least, we do until something happens that makes it difficult to adhere to the rules or we meet someone who does not follow the rules. In response to this disruption, we may react negatively since our expectations are being challenged. For instance, we might decide the rule flaunter is "crazy," "lazy," or some other label without truly understanding the reasons for their actions. In her book entitled *Mad At School,* Margaret Price discusses the importance of recognizing that some students simply are not able to show up in a classroom in the way that is traditionally expected. Perhaps the most striking point she makes is that, although physical disability is typically acknowledged in higher education, mental disability is not. She argues that the socially accepted ways of "being" in a college classroom are "Rationality, criticality, presence, participation, resistance, productivity, collegiality, security, coherence, truth, independence" and that these "intersect problematically with mental disability" (Price 5).

Students who are not able to meet the expectations embodied in each of those ideas can be labeled inattentive, lazy, or bad students. For instance, the idea of "participation" that Price brings up centers on the idea of being an active student in the classroom and most likely hinges on speaking and asking questions during class time. If a student suffers social anxiety though, the expectation to participate is significantly harder for them to meet than it is for a student who feels very comfortable speaking in front of groups. The concept of "presence" is also highly connected to participation. How a student shows up in a classroom can greatly affect the way the teacher and other students see them. Stereotypically "good" presence likely looks like speaking up in class, staying still and quiet when not speaking, arriving on time, and otherwise not disrupting the classroom. Thus, students who are too quiet, too loud, who need to stim to stay focused, or who deal with a mental disability that might, say, make it difficult for them to even get out of bed and get to class, are seen as showing up to class in an inappropriate way.

THE PROBLEM WITH APPROPRIATENESS

Clearly, how we show up in a space is something that can quickly become a very large and complicated issue. Price notes that we "are accustomed to thinking of classroom accommodations in terms of measurable steps that help 'level the playing field'" (59). However, this ignores students who are actively engaged and participating, but who are not engaging or participating in the ways that would be considered the norm. Many classroom expecta-

tions are not explicitly laid out. For instance, different professors want different kinds of classroom discussion but do not outright say at the beginning of the semester whether they are looking for deep, thought-provoking questions during class or that they are looking for neatly summarized answers from assigned readings. So, it is up to the students to figure out how to show up in the way a specific professor desires. Some students find adhering to these expectations fairly simple, but others do not. However, not being able to decipher what a teacher expects can have negative consequences for those students, particularly in the way that professors or others in power see those students.

Price names this phenomenon and the spaces it occurs in *kairotic spaces*, which are spaces that are "less formal, often unnoticed, areas of academe where knowledge is produced and power is exchanged" (60). They are spaces that include "real-time unfolding of events, impromptu communication that is required or encouraged, in-person contact, a strong social contact, high stakes" (61). All spaces in which there are no spoken rules about how to behave but certain behaviors are expected can be considered kairotic spaces. Classroom discussions, office hours, academic conferences, hallway teacher conversations, etc. all have a certain amount of import that can affect a student's standing in the eyes of those who are in power.

What further contributes to how students are perceived, particularly within the writing and language-focused classroom, is their skin color. What complicates the way race impacts "appropriateness" is that the color of one's skin skews perception even when one is acting "appropriately." Nelson Flores and Jonathon Rosa point out that "raciolinguistic ideologies produce racialized speaking subjects who are constructed as linguistically deviant even when engaging in linguistic practices positioned as normative or innovative when produced by privileged white subjects" (150). This pushes back against the commonly held idea that, if one only acts in an acceptable manner, nothing else matters. Thus, regardless of the way a person of color speaks or behaves, they often cannot escape the assumptions others make about them based on their skin color. Similarly, people with mental disorders or differences may also not be able to escape stereotypes about themselves, even if they are behaving in a way that is deemed socially "appropriate" by those in power.

To bring it back to the WC though, what does all this mean? In short, it means that these power dynamics exist in the WC and ENGL 321 and that we must be aware of how biases and assumptions affect our actions. ENGL 321 is a class, like any other class at UMBC, and both it and the WC are

subject to the same set of expectations that we collectively hold as part of higher academia. When students enter 321, they may assume the class will be structured similarly to other humanities courses they have taken and that the power hierarchy between teacher and students will be firmly in place. That power dynamic is something that also appears within the WC between student tutors and student tutees. Student tutees often ascribe power to the student tutor during sessions, assuming that the tutor is in charge of the session; in many ways, it seems as if student tutees sometimes see us tutors as quasi-professors ourselves. Even though we are undergraduate students just like them, we are often believed to hold a place of leadership and power as someone whose negative opinion might negatively impact them. Thus, I have had appointments with students who seem nervous saying what they think, apologize for eating during the session, feel the need to apologize for not appearing as if they are paying attention to what I'm saying, etc. The pressure to meet the requirements of behavior so often demanded in academia follows students to ENGL 321 and particularly follows students to the WC.

Then the question arises, "what do we do about this?" One possible response suggested in WC scholarship is to welcome a "trickster figure," whose main function is to serve as a "boundary-crosser" into the writing center. Anne Ellen Geller and her fellow scholars describe trickster figures and moments as people and spaces that are chaotic, complex, and unstable (Geller, et al 15-16). To provide an example, they bring up an instance in their own writing center in which a tutor was playing Scrabble with a student, which is not part of a typical tutoring session, and dissect how such occurrences should be handled. It could be seen as being too off-task and something that needs to be interrupted so the tutor and student pair can get back to the "actual" work. However, they highlight that the "Scrabble scene is interesting precisely because there is no accounting for a moment like this one in any tutoring advice or manual" (17). More importantly, they note that "Trickster moments like this one [the Scrabble moment] can be generative, can nudge us to be mindful" and that the tutor's "decision implies so much more about peerness and expertise, about rules, about environment" (17). The trickster position or moment can also affect how we perceive language depending on who is writing or speaking. Given that listeners often make assumptions about a person's intelligence or language "appropriateness" based on their skin color or race, it is important for tutors to push past those assumptions and confront the discomfort of their own beliefs and biases (Flores and Rosa). In essence, if we welcome the trickster moments that occur and allow ourselves to exist in

the discomfort of not entirely knowing what is happening or should happen, we open up to many more possibilities for thought and learning. Welcoming the trickster can push us to think about why we do what we do and to reflect on our own identity and place in a space.

WRITING AND POWER: TUTORS, STUDENTS, AND TEACHERS AS CIVIC AGENTS WITHIN AN OPPRESSIVE SOCIETY

As I noted above, "trickster" moments can nudge us out of comfortability and force us to think in ways that are not written about in places like training manuals. In addition, trickster moments also allow space for deeper and more nuanced learning and self-expression. A huge piece of this research is the idea that writing is a powerful tool for self-expression and self/civic agency. Once we push past the ideas we hold regarding power and the fear that can accompany trying to perform "well" within kairotic spaces, we can then move into realizing and understanding the power of writing. Our written communication and our communication surrounding writing can make the difference between understanding, belonging, and thinking deeply about self and others and feeling frustrated, excluded, and constrained to surface-level thinking.

As a writer of both creative and non-creative work, this is something that I have experienced firsthand and have given a lot of thought. My writing gives me a place to think through ideas, feelings, and emotions that might otherwise have no outlet. This research stems directly from a desire to connect writing and writing education to everyday living, but I did not have words for what I was thinking and feeling until after I had begun researching and writing it. Putting something into words makes it real in a way that simply thinking does not, and writing this paper provides me a place to further express myself, deepen my thinking, and help push the UMBC community towards what I envision it could be.

WHO ARE WRITERS AND WHAT IS WRITING?

In my experience, though, many students who enter the WC for a tutoring session do not see their writing as a way to express themselves and discover their place within a community. Instead, they see writing as a list of boxes that must be checked in order to receive a good grade on an assignment; they have to write on a specific topic, meet a word count, follow a certain formatting style, adhere to white, academic, standardized English,

etc. In short, they must create writing that fits into a certain box and are not often given the chance to break the box into the shapes their writing could take if they were allowed to explore. This mindset of "checking the box" is something that is ingrained in students before they enter college, and there are many professors at UMBC who attempt to push students to think more "out of the box." However, this is not the case for all professors. We often have students come to us in the WC with notes from their teachers telling them to "fix" their grammar or to adhere more closely to a strict rubric like the one I outlined above.

This is not to say that there is no place for assignments that focus on formatting, writing style, and grammar. In fact, my technical communication classes here at UMBC often had a huge emphasis on formatting, and the professors expected assignments to have a distinct voice that they outlined. The important thing to note here, though, is that these technical communication classes were upper-level English major courses that I took after lower-level courses that emphasized creativity and individual thinking. So, by the time I took classes in which I was expected to meet those strict formatting requirements common in technical writing, I had an understanding of the purpose of writing and the reasons why we write differently depending on the genre. Because of that, I did not feel constrained by the requirements or as if my own self was being pushed aside. I recognized that, even through fulfilling the very strict requirements, my writing still had power and was serving a very specific purpose.

When it comes to people who do not see themselves as "writers" though, either because they have just entered college or because their major does not require a lot of writing, the question becomes: what is the point of writing education? And, as an extension, what is the point of the WC as a place that assists with the writing process? There are many different views about the role of writing and who writers are. For instance, in their chapter in *Bad Ideas About Writing*, Dustin Edwards and Enrique Paz discuss the stereotype that only geniuses are "good" writers. This is the familiar idea that writers are people to whom writing comes extremely easily and that "True authors are not imitators; they are originators" or, "True authors are not made; they are born" (66). I have seen this belief come up in my own appointments many times. Many students assume that since I am both a tutor and an English major, I am a person who was born with a pen in hand, who never struggles with or needs help with her writing. To no surprise, this is highly inaccurate. Instead, like every other writer, I often hit blocks in the process and find myself grasping for words. Combating these stereotypes is important for all

students to be able to see writing as a place of possible power and self-agency for all, instead of only as an activity done by "mythical" writers who do not need to work at writing (Holbrook and Hundley).

Beyond the way that individuals see writing, writers, and the writing process, there is also the matter of what college writing classes are meant to teach. Tyler Branson makes the argument that introductory college English classes are not classes meant to teach grammar or to "correct" students' writing. Instead, Branson takes the standpoint that English 100 (and other similar writing courses) is meant to help prepare students to be actively engaged in civic discourse. In his chapter in *Bad Ideas About Writing*, Jacob Babb agrees with Branson and situates his argument within the history of English 100 courses and WCs being used to bring students "up to speed" as writers at a collegiate level:

> Rather than thinking of writing instruction as a form of triage, inoculation, or clinical diagnostic generated to protect the middle class from the ravages of illiteracy, we benefit from thinking of writing instruction as a means of helping students improve their abilities to engage in public discourse in all its varied forms. (27)

In short, as I mentioned above, writing education should be designed to prepare students to go out in the world as active and informed citizens and not necessarily just to make them what we would consider "good" writers. This idea of writing education as a process of learning how to be a person living within our society moves the written word out of the simple assignment space and into a more abstract space of enacting civic agency. Suddenly, instead of education being a dull routine in which students fulfill expectations and then move on to the next task, education becomes something fluid and entirely human.

PROBLEM-POSING EDUCATION

Paulo Freire calls this way of viewing education "problem-posing" education, saying, "In problem-posing education, people develop their power to perceive critically *the way they* exist in the world *with which* and *in which* they find themselves; they come to see the world not as a static reality, but as a reality in process, in transformation" (83). This is particularly important when it comes to how race affects the way language is perceived by the broader public, so that all students become able to think critically about their own language use and how they pass judgment upon the language use of others. Freire situates "problem-posing" education in direct contrast to the "banking" method of teaching, which is the idea that students are empty vessels that

must be filled by the teacher, like a bank being filled. Similarly to Freire, bell hooks situates education as a method of self-actualization, making the point that students want to be in a space that allows them to grow as scholars and people. She notes that "While it is utterly unreasonable for students to expect classrooms to be therapy sessions, it is appropriate for them to hope that the knowledge received in these settings will enrich and enhance them" (19).

Importantly, hooks does not limit the growth that can be gained from this method of teaching to the students. Instead, she highlights that students and teachers can both learn and grow together and that there does not need to be such a strict delineation between who is learning and who is teaching within a classroom or other educational space. Adopting the idea of teachers as learners along with their students pushes the classroom space further into a gray area. In the traditional banking system, everyone within the classroom is clear on what their role is: students wait passively to be given information, and teachers provide that information; minimal questions are asked, and those questions that are asked relate specifically to the topic being taught and do not delve into the *why* of what is being taught and how it is being taught. However, when the teacher-student binary is blurred, the roles, or rather the scripts we are accustomed to following, education suddenly becomes far more open.

Navigating that space, in which teacher and student are seen more as equals who all have a stake in what happens within the classroom opens both a lot of possibilities and a whole plethora of questions. As I mentioned before, power dynamics between professors and students and between tutors and students do exist. We cannot pretend that there is no difference in power because of the way that higher education, and education in general, is organized across the country. In addition, beyond the power difference, there is also a very obvious difference in expertise. After all, professors know more about the content they are teaching than the students in their classes, and tutors often have a more solid working knowledge of the writing process than other students might. To be clear, I am not saying that there is a difference in intelligence, but a difference in experience, comfort, and knowledge. Once we acknowledge this difference in expertise though, the question arises of how to strike that balance between passing along knowledge while also allowing space for questioning and becoming. David Hoffman discusses the difficulty that teachers face in walking this line between wanting to teach students and provide them with new ways of thinking they might not come to on their own and taking complete control of their education so they have no space to think for themselves. He writes that teachers need to make sure they are

"neither waiting passively and wishfully for students to make the imaginative leaps that lead to spontaneous learning, nor so enclosing and dominating their experience that they internalize unintended lessons about their own powerlessness and isolation" (Hoffman).

PUSHING AGAINST OPPRESSIVE STRUCTURES IN HIGHER EDUCATION

When education becomes focused on allowing students to ask *why* and on providing space for rule-breaking and "trickster" mentalities, education also becomes a powerful tool against the systems of oppression that are so prevalent in our society. Freire regards the banking system of education as oppressive in and of itself:

> Oppression—overwhelming control—is necrophilic; it is nourished by love of death, not life. The banking concept of education is also necrophilic. Based on a mechanistic, static, naturalistic, spatialized view of consciousness, it transforms students into receiving objects. It attempts to control thinking and action, leads women and men to adjust to the world, and inhibits their creative power. (77)

In reaching past the "necrophilic" methods of teaching, education can become a space that allows everyone to think creatively and individually and to become full, civic-minded members of their communities. When considering education centered around writing, this becomes even more important because writing teaches students how to think critically about the world around them.

PROPOSED CHANGES/LENS

The changes I propose for English 321 all follow a very similar thread, that of furthering the self-agency of students and creating an educational space that better allows for learning, free thought, and growth that recognizes the whole person. First, I believe that drawing from the Center for Democracy and Civic Life's theories and connecting the WC with other offices and spaces on campus could further the goal of making the center a space dedicated to the growth of civic-minded students. Second, I propose bringing in guest speakers to the class to broaden the knowledge base of the curriculum covered in the class and to provide future tutors with connections to faculty from various departments and research backgrounds. Third, I highlight the role of grades and grading methods and how grades might be used

to help tutors reflect more on the goal of their own education and learning style. Finally, I emphasize the importance of balancing the practical tutoring lessons with theory and the broader implications of writing and tutoring.

CDCL AND OTHER UMBC SPACES

The role of the Center for Democracy and Civic Life at UMBC

> "helps people develop the knowledge, skills, and dispositions to create healthy communities and tackle challenges together…The Center produces, inspires, and shares innovations in civic and democratic engagement, and supports collaborative activity that helps to build thriving civic cultures at UMBC and in communities involved in the Center's work." (civiclife.umbc.edu).

In a nutshell, the center helps the UMBC community, whether they be students, staff, or faculty, come into discussion with one another and work together to create a strong and inclusive community. I believe that the CDCL's focus on community building works in tandem with the focus of the tutoring course. Like the CDCL, the Writing Center's focus is also on creating a thriving and productive community for everyone who enters the space. Combined with the emphasis on writing being an act of self-agency and the WC's focus on pushing against societal oppressive structures, the WC becomes a space that is very similar to the CDCL, just under a different disciplinary umbrella. The CDCL focuses on self-agency in civic/democratic life and on creating change through facilitated dialogue and group effort while the WC furthers self-agency via the medium of writing and the tutor/tutee relationship.

The CDCL Civic Life Maxims, four of which I outline below, provide a way of thinking about the way we function within our society and how to help create a society that is more welcoming and civic-minded. They are as follows:

> *Civic life is everywhere (we are participating in civic society in every part of our lives, not just, for instance, when we vote in an election).*
>
> *People want to matter and belong (everyone, on a deep level, simply wants to be accepted and feel that they matter and belong somewhere).*
>
> *Stories are everything (our stories are what make us and what we use to communicate with others).*
>
> *Change happens (our communities are not unchanging and we each, individually, have the power to push for and enact change).*

These four maxims, which may seem like obvious statements to some readers, hit very important underlying ways of thinking that some students may not even recognize. On the surface one might respond by saying, "Well of course people want to matter and belong." The point seems small, but if one digs deeper and thinks about helping students matter and belong in the classroom space and the WC, the concept becomes massive. For instance, if we understand that ultimately everyone wants to feel as though they are accepted and matter, then a person's actions might be explained or we could approach a problem in a way that allows all involved to feel like they still belong. Or, if we understand that we enact our democracy when we do anything from going to the grocery store to sitting and doing homework in the library, we are then forced to think about the ways that our everyday behavior hinders or helps the communities we are part of. Each of the maxims have this same capacity.

By bringing CDCL theories into the curriculum, primarily through the Civic Life Maxims, I hope to help students in ENGL 321 see that the WC is not an island unto itself. Instead, the center is a space that is intertwined with other spaces on campus. The CDCL theories reflect a desire for a more interconnected community in which everyone is striving to be fully authentic and to question the way the world is. At the WC, and within ENGL 321, we also want to create a community of learners who feel free to be themselves, and who are comfortable both questioning and showing others that it is okay to question. Although I focused on the CDCL and the WC in my research, I believe that this is an idea that could be applied to many other departments on campus to help further connect the school together. By focusing on finding the connections between different offices on campus, I hope that future tutors will see UMBC not as a bunch of stand-alone programs, but as an intertwined community that they can then help their tutees navigate and find their place in.

GUEST SPEAKERS

Next, I suggest implementing guest speakers into the class. As I've noted above, Writing Center work can and does include many areas of study: composition studies, rhetoric, anti-racist and anti-ableist theory, gender and queer theory, psychological and interpersonal skills, etc. When you recognize the importance of every single one of those topics, the result is incredibly daunting. Each broad topic area has many other smaller rabbit holes that scholars might go on to earn PhDs studying. Thus, there is no possible way for any one semester-long class or one professor to be able to cover all that is

involved with WC work in any kind of thorough capacity.

Although there are likely many ways to handle the breadth of what WC work covers, I suggest implementing guest speakers throughout the semester to provide a focus on a set of different topics. This past semester, I was able to work with Professor MacDougall to bring three guest speakers to her ENGL 321 course. These speakers were Dr. David Hoffman, the director of the Center for Democracy and Civic Life (CDCL) at UMBC, Dr. Earl Brooks, an assistant professor in the English department whose research focuses on African American rhetoric, and Professor Lia Purpura, a poet and the artist -in-residence at UMBC during this time. I chose these three speakers because of the different areas of writing/tutoring that they could address.

David Hoffman led a discussion in which students were asked to think about how the CDCL maxims might apply in the WC and how they could inform tutoring. Many students focused on the idea that "stories are everything" and that "people want to matter and belong," listing them as important to tutoring because of their emphasis on stories and the feeling of belonging that WCs strive for. In a survey I gave to the Fall 22' ENGL 321 students, many listed David's discussion as a valuable piece of the class. In particular, a question that David posed at the end of the discussion seemed to provoke particular thought among the students: "Are we having a real discussion?" Considering the emphasis that I have placed on the idea of education being a means through which to understand oneself and the world, the idea of real/productive discussions is important. Using this question to frame certain conversations or to take a step back and reflect on what is actually happening within a discussion could prove extremely useful for future tutors to think about what they are doing in a classroom or tutoring session and why they are doing it.

The next guest lecturer who was invited to the class was Dr. Earl Brooks, whose research is centered in African American rhetoric. Anti-racism and making sure we in the WC are not part of enforcing adherence to standard, white, American English is a huge focus in the UMBC WC. However, it is difficult to know what acceptable writing really looks like within this broader framework. Even more complicated, it is difficult to know what to do when faced with a professor who requires a very strict, normalized, writing style for the student to receive a good grade. Or, in another example, it is hard to understand what is a student's stylistic dialect choice in writing and what is unintentionally misused grammar. To put it simply, as a tutor, I am sometimes unsure when it is okay to teach a student about sentence structure or to suggest they try writing in a manner more similar to the readings they

have for the class and when it is not. Sometimes, students simply do not fully understand how to put a sentence together or how to consciously choose the tone they want in their piece of writing, and teaching them actually provides them with a feeling of knowledge and power. However, other times, this kind of instruction can be a direct attack on who they are as a person and the way that they, and others that they love, write and speak.

During his visit, Dr. Brooks discussed this issue with the students and provided concrete examples of how tutors could navigate a session in which a tutor is unsure. This helped students better understand the reality of how writing and the way we view writing can enforce oppressive ways of being. One student wrote, "I think one of the things that the lectures made me more aware of was the effect of the culture of English writing on writers. How certain ways of writing and thinking are considered bad or wrong just because they don't fit this very Eurocentric standard" (Fall 2022 ENGL 321 Student). In addition, Dr. Brooks was able to open a discussion that often remains closed because it is a delicate subject. His position as a person of color in higher education who is studying African American rhetoric situates him as someone who can create the space for such a discussion.

Finally, Professor Purpura spoke with the class about different writing processes and tutoring strategies along with how to approach creative work in a tutoring session. One student noted that this conversation was particularly helpful to them, writing, "I learned so much. Like what the role of a tutor is when you're looking at someone's creative writing and how it's different, especially emotionally, from maybe an essay" (Fall 2022 ENGL 321 Student). Considering that we sometimes do have students who come in with a genre of writing that is creative, it is important to recognize that the tutoring process may be very different with them than with a student working on something like a research paper.

The feedback that students provided on the guest speakers was almost entirely positive. A few pointed out that some of what the professors talked about was similar to what they already knew, but most appeared to have found the guest lecturers to be helpful. One student wrote that "The lecturers all brought something different to the table that was in conversation with their specializations. This was great because it gave us different perspectives which is important in a diverse place like the writing center" (Fall 2022 ENGL 321 Student). In the future, I believe that continuing to bring other professors into the class could both help provide a focus on specific topic areas and could also help students and faculty alike see the WC as connected to the rest of the institution. The professors Professor MacDougall and I invited to the

class last fall were primarily English department faculty (besides David Hoffman), but I believe it would also be helpful to invite professors from other disciplines, particularly from STEM. Providing a connection between faculty from various departments and the tutors in the WC could create more clarity about what purpose the WC is meant to serve and also help complicate seemingly rigid ideas about writing among some professors at UMBC.

WHAT'S THE POINT?

For the past few semesters of ENGL 321, Professor MacDougall has used Assou Inoue's labor-based grading method. When I took the course in the fall of 2021, she graded using this method and continued to use it during the fall 2022 class. A fellow student who took the class at the same time as me noted that they appreciated the grading style because it made expectations clear and lessened the fear of a potentially bad grade. Other students in the class seem to agree that the grading method creates a more productive learning environment. Considering that the labor-based grading already works well within ENGL 321, I have only a minor idea to add: that of more explicit discussion between students and the teacher in regard to grades.

Regardless of whether assignments are graded traditionally or through labor-based grading, I think students often see their grades as coming out of thin air. The professor knows what they are grading on, but the students may not fully understand what the professor does. In his chapter in *Bad Ideas About Writing*, James R. Mitchell discusses the fact that, "The grading process in place before the late 19th century hinged more on direct contact between student work, course content, the student, and the teacher. For example, in English classes, teachers would respond to student writing in both written and spoken form" (Mitchell, 267). I believe that this method of grading in the form of more explicit conversation and direct contact could help students better understand the grade they earn, the amount of labor they put into an assignment, and how other professors might grade writing.

To do this, I propose using a kind of dual grading system: the traditional rubric-based assignment sheet that divides the assignment up by percentages of grammar, style, formatting, citations, etc., along with the contractual grading system that grades based more on labor and effort instead of a value system. In terms of the traditional percentage/letter grade system, I suggest that students be required to critique their own writing based on the criteria outlined. Then, and most importantly, I suggest that students have a more holistic conversation with the professor about the effort they put into their writing and why they gave themselves the letter/percentage grade they did.

Finally, the student and professor will come to a decision about what requirements the student has met for the labor-based grading system and agree upon a grade that reflects both their writing, their effort within the class, and any outside life occurrences that may be impacting their presence in and out of the classroom. I hope that this very explicit and open grading system can help students see more clearly how writing is graded, since everyone has a different idea of what "good" writing is, and will also help make it clear that their education is in their own hands and that quality of learning does not always equal quality of grades.

HOW DO WE ACTUALLY TUTOR?

While I was completing this research and asking for feedback on ENGL 321 and tutoring from my fellow tutors, a common theme popped up: that of not being entirely sure how to reconcile the theories we learn about in ENGL 321 with their concrete tutoring practices and the desire for a focus on practical tutoring strategies during the class. One student wrote that they "felt that we were really well prepared with the theory/pedagogy aspect of tutoring, but [they] would have liked a little more experience with "hands-on" tutoring" (Writing Tutor). Other students made suggestions like having "More applicable methods for tutors to apply" (Writing Tutor) in the class and that the class could have "maybe have a week where we work on grammar to refresh our memories?" (Writing Tutor). The common reasoning behind these comments was the sense of uncertainty that new tutors felt when beginning to work with students during their own sessions and that, even though they had a grasp on the WC theory being taught, they were not sure how it fit into actually tutoring a student. A student who was part of the fall 2022 ENGL 321 class sums this up neatly: "I think most things were helpful. However in actualization when tutoring I feel like it was hard balancing the class's message, 'everyone has their own voice with their own English', and helpful responses to students' questions on how to improve" (Fall 2022 ENGL 321 Student).

There are many methods that could help better connect the theory and practice of tutoring along with helping burgeoning tutors feel comfortable leading their own sessions. A few of my ideas, and those from other students in the survey, follow a similar thread of simply having a few more sessions that focus on the logistics of tutoring. For instance, one tutor suggested having a session focused on different writing genres, so tutors have the chance to familiarize themselves with ways of writing that they may have not done for years or ever. Similarly, other students suggested having other classes focused on clarifying the mentor/mentee relationship and purpose and work-

ing in more time for beginning tutors to work with more experienced tutors. Importantly, even though the theory and practical tutoring practice can feel like two separate areas, they are not. To make that connection clearer, I think tying the theory to concrete practice or strategies could work very well. For example, after a conversation about how racism and white-supremacist ideas can be embedded within writing, it could be helpful to then pose a series of scenario-based "what would you do?" questions to the students in the class that have to do with the topic being discussed. This would allow students to think about how they could handle situations in the WC while also showing them how the readings connect to their tutoring practice.

Of course, teaching any kind of strategy in ENGL 321 runs the risk of teaching tutors to follow the rule book and not feel as comfortable engaging in those trickster moments that Geller and her peers discuss. Striking the balance between leaving tutors on their own to figure out how their style of tutoring connects with the theory and shoving grammar rules, techniques like directive and non-directive tutoring styles, and other practical strategies down their throats, requires a careful hand. After all, part of the goal of ENGL 321 is to help students recognize their own tutoring style, so leaving that space for them to experiment and come into their own is incredibly important. However, thinking about how to include more concrete tips so tutors feel more equipped to start working with students could prove very useful for future ENGL 321 students.

CONCLUSION

As I wrap this research up, the primary takeaway I have is that this is barely even a drop in the massive ocean that is pedagogical theory and teaching. Education is an incredibly powerful and nuanced process and it has a huge impact on the society we co-create together. Ultimately, we are what we learn; we are what we know. Coming to terms with that idea, that people become who they are based on what they are exposed to, what they learn, and how they are taught to learn, is something that I think all educational institutions need to think deeply about.

In regard to ENGL 321, I think that there is ultimately no "right" way to teach tutors how to work with students. Writing education and tutor/teacher education are not one-size-fits-all disciplines. Instead, they are more akin to art and depend highly on the specific individuals involved. What works well in one ENGL 321 class may flop in the next year's class, and what one student in the WC finds very helpful during a session may be entirely unhelpful for another student. There is no way to account for the differences in

how different classes learn until we are already past the point of backtracking and readjusting the teaching style or content without anyone noticing and sometimes even past the point of being able to change things too much. For instance, a professor teaching ENGL 321 cannot completely remodel the syllabus four weeks into the semester. Thankfully, during tutoring sessions, backtracking is significantly easier, but it can still cause tension and confusion between the student and tutor.

Ultimately then, ENGL 321 must try to strike a balance between providing tutors with the tools necessary to feel comfortable working with students and also instill in them a sense of their own capacity to be flexible, as needed. Or, as a Writing Center tutor put it:

> "Writing tutorship is inherently special as a singular, subjective, and unique experience from session to session. According to the saying, we must move from (1) knowing the rules to (2) knowing how to break them. The beauty in pedagogy is then that, rather than right and wrong, there is gray space, room to grow and adapt, being flexible between tutoring styles and ideas" (Writing Center Tutor).

As that tutor writes, we walk the bridge between rules and complete flexibility, and it is up to us to know when to follow those rules and when to break them. Tutoring is a practice that requires a fine-tuned eye to the way different people respond to the vulnerability of writing, the stress of higher education, and simply communicating with another individual. The ENGL 321 course already works well to prepare tutors to do this in the WC. This research is meant to provide a closer look at what we are striving to reach together through the class and in the WC and imagine how we might more closely meet those goals. After all, we can only create the world we want if we can imagine it. By troubling these ideas I hope to trouble the small world of ENGL 321 and the WC as it is and to push it further towards the "paradise" that bell hooks imagines higher education could be.

APPENDIX A

Section 1: Writing Tutor Survey Questions

Your name? (optional)

What semester did you take English 321?

How well do you think it prepared you for tutoring in the Writing Center?

Could you elaborate on your response to the previous question?

What do you think worked well in your English 321 course?

What do you think didn't work well in your English 321 course?

Any ideas about how to help English 321 better prepare tutors?

Section 2: Fall 2022 ENGL 321 Survey Questions

Your name? (Optional)

On a scale from 1-5, how well do you think English 321 prepared you to tutor?
Can you elaborate on your answer to the previous question?

What was something you learned or did in the class that really impacted how you approach tutoring? Please explain why it was helpful.

What was something that you learned or did in the class that you felt was not verhelpful? Why was it not helpful and do you think that others may have found it helpful?

What are your thoughts on the three guest speakers? Did you take something away from their lectures/discussions? If so, what are your takeaways?

Do you have thoughts about how a tutoring class could better prepare tutors?

Any other thoughts or ideas that you would like to share?

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10

The Infinite Language Well: Linguistic and Cultural Influences in Learning and Researching Quantum Physics

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BIOGRAPHY

Layla Ahmed graduated cum laude with a B.S. in physics, a B.A. in cultural anthropology, and a minor in astrophysics in spring 2023. She plans to attend graduate school to earn her Ph.D. in physics with a focus on physics education research. Her anthropology capstone project explores the influences that come with learning and researching quantum physics in terms of language and culture. Layla would like to thank all of her professors and classmates at UMBC for consistently encouraging and guiding her throughout her academic career.

RESEARCH JOURNEY

Informing several individuals that I was both a physics and a cultural anthropology major came with various reactions that either showcased one's disgust for physics or one's unawareness of anthropology. The most common response I received, however, was a question regarding what I would be able to do with the two fields altogether. This question always lingered in my mind and has been one of the most compelling challenges I've dealt with thus far, as I picked up both fields simply because I was interested in them. The anthropology capstone project, however, gave me the opportunity to produce a very informed answer for this question purely inspired by my own experiences as a physics student at UMBC.

This research explores the influences that come with learning and researching quantum physics in terms of language and culture. This project found that physics students and professors bring their own linguistic and cultural frameworks to learning and researching quantum physics, which create barriers to participate in the field, but also provide a necessary foundation. These findings shine light on some of the barriers that may keep promising new scholars from becoming involved in this important line of scientific research and discovery.

ABSTRACT

Quantum physics is a field that is currently exploding with fresh and exciting contributions to science. Much of its appeal to physicists stems from its range of applications, from MRIs to computational methods. The first step to working on these applications is understanding the theories of quantum mechanics; however, it is the theories that make quantum physics one of the most intimidating fields to approach for physics students. This is partly due to unfamiliar vocabulary and connotations from pop culture. Schrödinger's wave equation, the superposition state of particles, perturbation in infinite square wells, and other topics in quantum physics sound dauntingly complicated. Also, films like *Ant-Man and the Wasp: Quantumania* and other forms of entertainment portray quantum physics as a brand-new science that explains phenomena, like time travel, that have yet to exist. In order to explore these impediments to learning and researching quantum physics, this study used ethnographic methods. This included participant observation within undergraduate and graduate study groups, classrooms, research settings, and colloquiums, as well as interviews and an "ethocharrettes" elicitation activity with students and faculty in the University of Maryland, Baltimore County (UMBC) Physics Department. This project found that physics students and professors bring their own linguistic and cultural frameworks to learning and researching quantum physics. The ways that students have learned to talk and think about the world based on their real-world experiences cannot capture many of the core ideas in quantum physics. However, this prior learning in classical physics is seen by the experts in my study as a necessary foundation that allows students to differentiate this new field and understand it further. These findings shine light on some of the barriers that may keep promising new scholars from becoming involved in this important line of scientific research and discovery.

INTRODUCTION

I still remember how, during my sophomore year as a physics major at the University of Maryland, Baltimore County (UMBC), the professor would start his lectures for my lower-level physics course by showing what he had just taught in the only quantum physics course available for undergraduate students. He did this hoping to pique everyone's interests. His whiteboard would be filled with extensive lines of advanced mathematical integration and several symbols I had never seen before, just like the cliché science proofs I had seen in the movies. For me, however, his tactic had the opposite impact. Rather than drawing me in, I was intimidated. I still remember another quantum physics professor telling me he had spent an entire night in his lab without sleeping because his equipment called for nonstop attention. That is how much effort and patience are required for each experiment. Although study sessions lasting well into the night are common for college students, staying up for the sake of a lab instrument sounded too stressful to me at the time.

Eventually, I attended that undergraduate quantum physics course in my senior year, as most physics majors at UMBC do. When I did, I discovered that, while the advanced mathematical integration looked extensive, it was simply repetitive, and the mysterious symbols were just Greek letters—used throughout all of physics. The build-up about the difficulty of the class did not match the true difficulty my classmates and I faced, and something that seemed incomprehensible at first was somewhat straightforward. Although the course was still tough and demanding, it was not as impossible to grasp conceptually as it had appeared.

During my final semester at UMBC, I took the capstone class for my cultural anthropology major. This course required each student to conduct their own independent anthropological research by immersing themselves in a certain community and eventually producing an ethnographic analysis of that community. I determined that there was no better community for me to describe than one I had already been immersed in for years: the UMBC Physics Department.

Through this ethnographic research project, I explored connotations around quantum physics and why it was perceived as highly unfathomable and taxing to individuals, particularly physics students like me, with no elementary knowledge of it. I also investigated how such connotations may hinder a physics student's interest in the subject the way it did mine. Based on my ethnographic research, I found that physics students and professors bring their own linguistic and cultural frameworks to learning and researching

quantum physics. These frameworks create barriers to participating in the field but, in some instances, provide a necessary foundation. In this article, I will discuss some of the disciplinary gaps that my project aims to bridge, describe my data collection and data analysis methods, define the kinds of barriers that show up throughout learning and researching quantum physics, and explain how and why a student or professor's linguistic and cultural framework is important for understanding quantum physics.

BRINGING ANTHROPOLOGY TO SCIENCE: BRIDGING THE GAPS

As a physics and anthropology dual degree student, one of the most interesting challenges I faced was trying to bridge the gap between the two fields. Science and technology studies (STS) is a category within anthropology that has certainly been helpful in doing this, with Jennifer Robertson's *Robo Sapiens Japanicus: Robots, Gender, Family, and the Japanese Nation* (2017) being a fine example. In her ethnography, Robertson analyzes Japan's booming interest in robots, claiming that the characteristics of the robots reinforce Japanese gender roles and stereotypes. Robots that carry out tasks like cleaning are designed to have a feminine appearance while robots that carry out heavy lifting tasks are designed to have a masculine appearance (2017). Through this study, Robertson was able to form a substantial connection between technology and anthropological understandings of gender in Japan. What my study aims to establish is a connection with just as much substance between quantum physics and anthropological understandings of culture and language in the physics community. While Robertson used anthropological methods to identify Japanese gender standards reflected in their technology, in a similar sense, I wanted to use these methods to examine how the linguistic and cultural frameworks of the participants in quantum physics are reflected in their work.

I initiated this study knowing that such a gap would be present, but I did not expect it to appear right from the beginning. When introducing my project to the physics professors I wanted to include in this study, I had trouble explaining "linguistic and cultural frameworks," terms I learned through my anthropological coursework and that I will use throughout this article. The physicists, drawing on common understandings, assumed that a "linguistic framework" was the literal language or languages known by an individual. Likewise, they understood my use of the term "cultural framework" to refer to standard ideas of ethnic backgrounds, religious beliefs, familial practices,

and other related factors. Neither definition was what I conceptualized for this study, so I used physics-related examples to convey to the participants what I meant.

To illustrate to physicists what a linguistic framework is, I used a theory in physics known as Wave-Particle Duality, which I learned about during my physics coursework. This theory states that light possesses characteristics of both waves and particles. Some scientists understand this as light being a particle or a wave, light being a particle and a wave simultaneously, or light being neither. To individuals outside of physics, this is equivalent to claiming, for example, that there exists an object that is both a book and a water bottle. This can be very difficult to visualize because a book and a water bottle generally do not possess similar characteristics, yet said object acts as both and can be described as either. How someone develops a way to describe an object, and how that description is perceived, or, similarly, how physicists developed a way to describe light and how that description is perceived, is what my study addressed as a linguistic framework. It refers to the words one has come to use to describe their reality.

Language framing what we can know is related to a principle in anthropology known as linguistic relativism (Scholz 2022) and is addressed as the Sapir-Whorf Hypothesis. Edward Sapir and his student Benjamin Whorf both approached the creation and growth of language as the result of one's meaningful interactions with their environment. For example, an individual who comes across an animal will create a linguistic symbol that refers to that animal (Sapir 1912). This shapes how that individual thinks, which in turn will shape their reality (Kay and Kempton 1984). This also means that unlimited interactions between an individual and their environment can ultimately overcomplicate how something is linguistically symbolized. Looking back at the Wave-Particle Duality Theory, a phenomenon like light has been linguistically symbolized in a way that is not collectively coherent to everyone, leading to some scientists being inherently divided in their definitions as I have seen throughout my coursework.

I used another example to explain to my participants what I meant by "cultural framework," drawing on a tale that has become popular among my physics classmates. During one of my physics courses, my professor would always begin his lecture with a discussion that I was consistently asked to participate in. One of the questions he would occasionally ask was, "What will happen if I throw this pen at you?" The obvious response was that the pen would hit me, but he would always follow up with the same question: "How do you know that?" The unexpectedly uncomplicated answer was that I know

based on my experience; I know that his pen will hit me if he throws it at me because I have had something thrown at me before. My ability to determine what has happened, what happens, or what will happen around me through personal experience is what this study addressed as a cultural framework; it referred to one's understanding of their everyday lived experience. In terms of physics, classical physics presents terminology and mathematical solutions that describe such experiences. A pen being thrown would be an example of a concept known as projectile motion.

Linguistic and cultural frameworks are inevitably intertwined, of course. This is well illustrated in Emily Martin's "The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles" (1991). In this article, Martin examines how gender stereotypes influence scientific depictions in medical textbooks of how the male and female reproductive systems function. This shapes and limits what can be understood about these organs and their processes, behaviors, and abilities. While female organs, menstruation, ovulation, and female reproductive processes are given bare, demeaning connotations, with the egg passively awaiting the strongest, most aggressive suitor, the male organs and reproductive processes are seen as the primary actors. Martin shows how the language of these descriptions derives from stereotypical social and cultural beliefs. Above all, such descriptions are inaccurate and misleading. In Martin's paper, she provides many examples of illustrations of reproduction to demonstrate how scientists have somehow implemented their cultural frameworks regarding gender within their new linguistic symbols. Similarly, quantum physicists are using their cultural frameworks to linguistically symbolize light as a wave and a particle, and conflict arises when said cultural frameworks differ from each other, resulting in disagreeing linguistic symbols.

The ways in which linguistic and cultural frameworks shape how technical knowledge is taught and understood can play a significant role in how students are socialized into professions and how professions themselves are structured. A good example of linguistic frameworks is seen in Elizabeth Mertz's *The Language of Law School: Learning to "Think Like a Lawyer"* (2007) where she describes a "common vision" found in law school classrooms. This common vision emphasizes authority rather than morality through an underlying "linguistic ideology." Her research confronts how this common vision across American law school classrooms limits and contradicts core values within the American practice of law and American politics, specifically the idea of democracy (2007). While the language being used or taught is not at the forefront of a law school classroom, placing a spotlight on the lan-

guage used in the classroom opens up an entire domain of information that, in Mertz's case, exposes the intentions of the profession at hand. By placing a spotlight on the language used in a quantum physics classroom or research setting I also wanted to see what would be revealed about the profession itself, particularly relating to why the subject is difficult at first glance.

An example of how cultural frameworks also shape the ways that science is learned and professionals are socialized can be found in *Birth as an American Rite of Passage* (1992) by Robbie Davis-Floyd, in which she examines births that take place in homes and in hospitals. In the chapter titled "Obstetric Training as a Rite of Passage," Davis-Floyd claims that the training obstetricians undergo during medical school is, as the title of the chapter states, a "rite of passage" for their specialization, and it is this training that teaches them to understand and think about birth in a particular way. Similar to Mertz's work, Davis-Floyd's analysis of the medical school training given to future obstetricians exposes the intentions of the profession. The training itself is a cultural framework that is structured and imposed onto medical school students in a way that aligns their values with the values of the medical system. Looking at how the training of quantum physicists impacts the way they understand and think about the field is ultimately what my study is about.

A different kind of gap appeared in my project regarding the learning and researching environments I worked with. Despite having experience in physics classrooms and research meetings, the graduate classrooms and research settings were unfamiliar to me. The book *Language, Ethnography, and Education: Bridging New Literacy Studies and Bourdieu* (2012) describes what a classroom's dimensions, characteristics, and dynamics represent. David Bloome, one of the anthropologists behind this ethnography, explains that classroom ethnography can reframe what defines a classroom beyond education and knowledge, and rather in terms of socialization, relationships, and enculturation (Grenfell, Bloome, Hardy, Pahl, Rowsell, and Street 2012). My study aimed to incorporate Bloome's interpretation of classroom ethnography and analyze quantum physics beyond the actual content, where there are students and professors, relationships between them, and linguistic and cultural frameworks among them. Rather than addressing the definition of light, I addressed a community of people who use their frameworks to develop this definition within learning and researching environments, as well as how this definition further develops their frameworks.

METHODOLOGY: CONSENT, DATA COLLECTION, AND DATA ANALYSIS

The community of study for this project was the Physics Department at UMBC, with a focus on professors and graduate students pursuing quantum physics research at the time. An undergraduate physics study group, which I was a part of, as well as guests for the colloquia hosted by the Department were also included. Out of the professors I worked with, there was only one I met for the first time through this project as the other two taught undergraduate courses that I took. Out of all the graduate students I worked with, I recognized only one from a previous class I took, in which he was the teacher's assistant.

It is important to note that, prior to any sort of data collection, I followed the IRB protocol that was approved by UMBC for my capstone class. On receiving approval, I contacted three professors in the physics department who conduct research in quantum physics and asked to meet with them to introduce my project. During those meetings, I went through a verbal consent process where I explained to them that I required their consent to include them in my study, that they were free to withdraw their consent at any time without any consequences, that no identifiable information would be disclosed unless otherwise specified by the participant, and that they were free to access my research notes at any time. I received verbal consent from each professor to involve them in this study as well as permission to sit in on their classes and research meetings.

There are three methods I carried out for data collection. The first was participant observation. The importance of participant observation comes from the fact that the researcher is assuming the role of their participant rather than writing notes from afar about what other participants are doing; it represents life experience in the most authentic way possible (Emerson, Fretz, and Shaw 2011). Before beginning this method, I went through the same verbal consent process as before, either in a group setting or individually. I was able to do participant observation in a graduate quantum physics class, three quantum physics research groups, my undergraduate study group, and at the colloquia. Following each period of participant observation, I recorded my observations as extensively as possible in my field notes.

The second method I used was interviewing. I went through the same verbal consent process with each interviewee, with an additional request that I audio record the interviews. I held an informational interview with a professor to gain insight into the field of quantum physics itself, what it is like doing research in such a field, and what it takes for a student to enter the

field. I also held a person-centered interview (Levy and Hollan 2015) with a graduate student researching quantum physics. This was to learn about his personal experience and organization as a student doing such research, why he entered the field, and his research itself. He defended his dissertation after the interview and now officially has a PhD in physics.

The third method was an activity known as "ethnocharettes" (Marcus and Murphy 2011). In simple words, it is brainstorming using sticky notes. After going through the verbal consent process, I asked the undergraduate study group to use sticky notes to answer three questions written on a whiteboard. The questions were:

> *What do you think of when I say "quantum physics"?*
> *Thoughts on quantum in the media (pop culture)?*
> *How do you feel about quantum physics? Elaborate.*

I had students who took the undergraduate quantum mechanics course and students who had yet to take the course use two different colored sticky notes in order to differentiate the responses. The purpose of this method was to reveal to everyone involved their underlying interpretations of the topic being discussed, quantum physics being the topic in this case.

To protect the identities of all the participants involved, I have not used their real names or other personally identifying information. For students, I used single letters in place of their names, and for professors, numbers.

To analyze my data, I qualitatively coded my field notes, the transcripts of each interview, and the set of sticky notes from the ethnocharettes activity to look for common themes. Key commonalities that emerged included mentions of specific math concepts, coding programs, classical physics, and more. I also looked to see what kind of linguistic and cultural formulations were common across the data and how the participants understood these. This analysis helped me understand the patterns present in my community of study and how they function.

RESULTS AND ANALYSIS

Throughout my analysis, I found that the linguistic and cultural frameworks that physics students and professors apply when learning and researching quantum physics create barriers to participating in the field. These included new, sometimes counterintuitive concepts that participants found challenging to describe with familiar language and mathematical approaches as well as popular media connotations that interfered with their understanding. As I will describe later in this section, however, a foundation in these

frameworks was also understood by my participants to be a necessary entry point to the study of quantum physics.

The first barrier that emerged as significant in my study is that quantum physics introduces students to unfamiliar terms and concepts. At UMBC, as learned throughout my coursework, the upper-level physics courses are typically extensions of ideas taught in one of the two introductory physics courses. For example, Physics 303 is thermal and statistical physics, which is first introduced in the second introductory class, Physics 122. Quantum physics is the exception as it is not introduced in either of those classes. There is a short, two-chapter long glimpse in Physics 324, *Modern Physics*, but it is very brief compared to the depth quantum physics holds, and it is generally a late introduction compared to other topics. For reference, I was personally first introduced to classical concepts like velocity and motion when I was in sixth grade, but I was first introduced to a central quantum mechanics concept known as Schrödinger's Wave Equation only two years before this project as a sophomore in college. A thorough lesson on quantum physics for the students at UMBC is not presented until they take Physics 424, the only undergraduate quantum physics course available, which typically cannot be taken until their final year due to prerequisites.

Not only are these concepts mostly new, they are also counterintuitive compared to classical concepts like projectile motion and the pen example discussed earlier. In the undergraduate quantum mechanics course, one of the first ideas taught is known as a collapsing wave function. In simple words, a wave function represents a particle, and it collapses when a measurement is taken (Griffiths and Schroeter 2018). Learning about collapsing wave functions at the very beginning of the course is equivalent to learning about velocity and motion in a classical physics course; it is a foundational concept. When I first introduced my project to one of the professors in the quantum physics field, who I will address as Professor 1, he openly admitted to me that he still does not completely understand what a collapsing wave function is. "How do you wrap your head around that?" he asked. A professional who is so deeply embedded in the field is unable to fully comprehend a fundamental idea because it is counterintuitive; it is not a part of one's lived experience the way a pen being thrown might be. What does it mean for a particle to be represented by a wave? What does it mean for that wave to collapse? Why does it collapse after a measurement? These are questions that are answered in quantum physics, but they are not as easy to answer as "What will happen if I throw this pen at you?"

I brought up this story about Professor 1 in my interview with the grad-

uate student, who I will address as Student A, and asked him if there was any concept in quantum physics that made him feel the same way. His response was the following:

> *[laughs] Well yeah, so I would say that there was no collapse of the wave function. But still, even without that assumption...one that would be interesting to tackle is, is really understanding the meaning of probability or the meaning of a branching of wave function. So what do we mean by that? What do we mean by a wave function in a quantum universe to begin with? So...how to make this connection to like a global wave function of the universe to something that is intuitive to us. Is there a way to make that or maybe there is none. So maybe there is no way to make just making the mathematical analogy. But again, the question here, since we're we're trying to understand phenomena kind of predict, what's going to happen next? So is it useful to think about these questions? Is it scientific? So what are we going to gain by thinking about the wave function of the universe? So can we make–can it have some predictive power? And that's the thing that I'm still trying to understand.*

The opening statements by the professor and the student present a re-enactment of the Wave-Particle Duality Theory debate, but in terms of the collapsing wave function. While Professor 1 still considers collapsing wave functions, Student A stated that wave functions do not collapse at all. Two physicists, with backgrounds in quantum physics specifically, have conflicting perspectives on a foundational concept, which easily leaves room for conflicting perspectives on anything else that is brought up in the field. This not only complicates current theory but also implies that there is potential for complications in developing theory, which can be off-putting for new students like me.

Student A then took a further step back than Professor 1 to say that he still does not completely understand what is meant by a wave function, wondering if there is a way to make the idea more intuitive. While Student A simply desires total comprehension of an underlying concept to see how he can improve it, his statement revealed that, even after years of doing doctoral research in quantum physics, some aspects remain uncertain. The idea of intuition, as mentioned by him, will be brought up again later.

In physics, with new terms and concepts come new mathematical techniques and analysis. While sitting in Professor 1's graduate quantum physics course, he covered the density operator or density matrix, which is a way of describing common scenarios in quantum physics, such as ensembles of

pure states (Nielsen and Chuang 2010). While covering this, however, he stated that he does not "like probabilistic functions" like the density matrix, but rather prefers deterministic functions. When I had a chance to talk with Professor 1 more about this during our interview, he said the following:

> *I would say that the most fundamental difference between classical mechanics and quantum mechanics is that classical mechanics is deterministic, right? You can set up initial conditions, and you know exactly what's–what you're going to measure at the end...In quantum mechanics, that's not the case. It's not deterministic. There is this probabilistic–probabilistic behavior that we're stuck with. We can't say for sure what's going to happen. We can only assign probabilities to what we're going to see... [The density matrices], they're averaging over degrees of freedom that we don't know about, but here's the crazy thing is that that that is something where the density matrix or even, you know, so we were talking about reduced density matrices, right? The density matrix that describes some small part of a larger system. We're saying, if you look at the small part of the of the larger system, and you don't know what's going on in the larger system, you just kind of average over the possible outcomes of the larger system, then yes, you get this probabilistic description of, of the subsystem, but like, the strange thing is that in quantum mechanics, even if you know all the degrees of freedom in the larger system, even if you don't average over anything, you still have probabilistic behavior, right? So that's, that's really the crazy part.*

Based on my knowledge from my undergraduate quantum mechanics course, in addition to what Professor 1 described, much of the mathematical analysis involved in quantum physics is probabilistic, and thus the results are probabilistic. Because we, as physicists, do not entirely know what is going to happen in a quantum system until a measurement is made, probabilities are how to make the most of the information at hand prior to any measurements. This is in comparison to deterministic mathematical analysis as seen in most classical physics, where one knows from start to finish what is going to happen. Thus, deterministic math can be used to represent the entire situation. Going from knowing everything that takes place and will take place in a system to not having all of the information possible requires a significant change in the mathematical techniques required to characterize a situation. To put this into perspective, if I want to understand a quantum system that I am looking at, but I can only describe it using math that isn't as detailed as the math used to describe a classical system, then I might not be able to fully understand it, par-

ticularly in terms of the predictability of the system. Rather than letting that stop me, however, I should accept the nature of the theory because quantum physics does ultimately describe the world around us.

Another type of barrier that I found for new students was how quantum physics is seen in the media, particularly in popular culture. In the ethnocharettes activity, I asked what thoughts the undergraduate study group had on quantum physics in the media and pop culture. Figure 1 displays a few of the responses, with sticky notes b, c, d, e, h, and i coming from students who have yet to take the undergraduate quantum course, and sticky notes a, f, and g coming from students who already took the course.

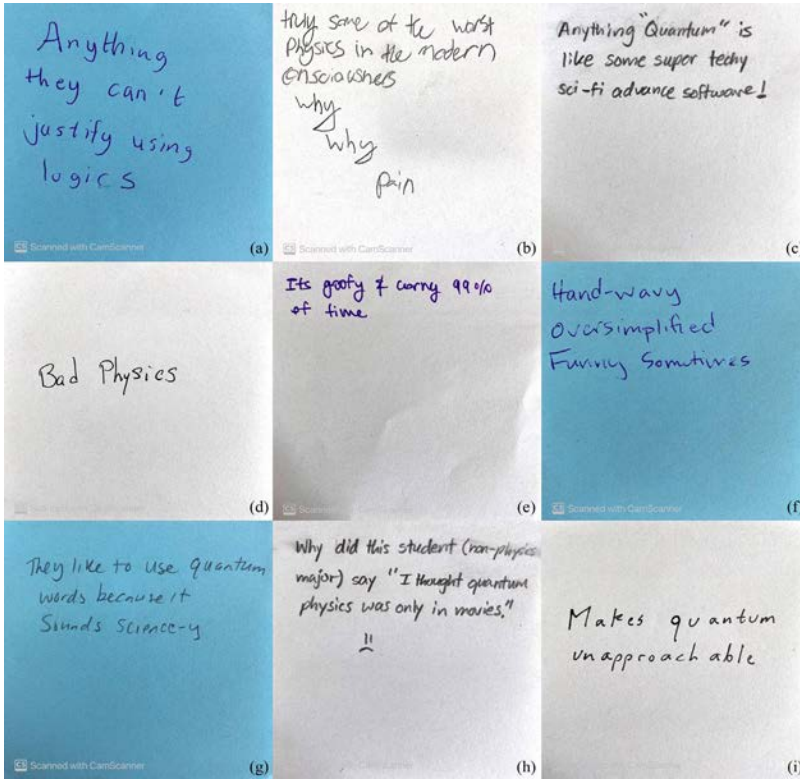

FIGURE 1.
Pictures of some of the sticky note responses from the ethnocharettes activity.

Here we see that physics students, including those who had yet to take the undergraduate physics course, voiced a belief that the so-called quantum physics that is constantly portrayed in the media is not an accurate representation, as seen in Figure 1(a) through Figure 1(i) in which they say: (a) "Anything they can't justify using logics" (b) "truly some of the worst physics in the modern consciousness why why pain" (c) "Anything 'Quantum' is like some super techy sci-fi advance software" (d) "Bad Physics" (e) "Its goofy & corny 99% of time" (f) "Hand-wavy Oversimplified Funny sometimes" (g) "They like to use quantum words because it sounds science-y" (h) "Why did this student (non-physics major) say 'I thought quantum physics was only in movies.' ☹" (i) "Makes quantum unapproachable"

It is important to highlight the responses of students who have not taken quantum physics, such as the individual who said that media "makes quantum unapproachable" (i in Figure 1) or the individual who reported with a sad-face emoticon hearing another student say "I thought quantum physics was only in movies" (h in Figure 1). These students may be discouraged from studying quantum physics by such representations, despite being aware of the poor portrayal. If quantum physics is continuously depicted as some mysteriously difficult subject that somehow explains impossible concepts like time travel, students who do not have a proper grasp of the subject may be misled into believing that it is so difficult that it is indeed "unapproachable."

Although my research demonstrated that these kinds of linguistic and cultural frameworks present barriers to participating in the field of quantum physics, it also showed that these frameworks provide a necessary foundation for understanding the material. These frameworks and other life experiences serve to produce an intuition about how things will unfold, an intuition that is foundational to classical physics, and by extension to quantum physics. To reiterate the pen example, I explained that if my professor throws a pen at me, I know it is going to hit me based on experience. Intuition is based on one's perception of experiences like this and continues to develop with more experiences, whether they are new, recurring, or shared. For example, if I drop a tennis ball on the floor, I know it is going to bounce back up, or if I rub a balloon on my head, I know my hair will lift up. Describing these scenarios and phenomena is what classical physics does; it is based on the visible, experienced world. A physicist needs that intuition and their everyday lived experiences, along with the words they use to describe it, in order to conceptualize and apply classical physics. Being able to conceptualize a problem in classical physics through one's intuition allows for solutions or characterizations to be determined. Without that intuition, it becomes extremely

challenging to visualize a situation and how it will play out. If I am unable to picture what a pen would look like when thrown at me, I will have a difficult time trying to describe what is going on in physics terms. Furthermore, I will have an even more difficult time applying those concepts in situations that I may be unfamiliar with but use the same physics concepts (projectile motion in the pen example), such as a rocket launch.

A physicist needs classical physics to understand quantum physics. In my interview with Student A, I asked him how he would explain what quantum physics is to someone who has no knowledge of it. His answer was the following:

> *So I would say I'm assuming they know classical and they know particles and molecules. So I will just basically, there is no need for like layers of complication to explain it just say that that it turns out that the approximate laws that we derive for particles and the things that move classically that we see are not correct. And the correct way is to describe things from basically, from looking at small systems looking at particles and molecules, because they have weird behavior. And there are different laws than the ones that we are used to. And that's what's called quantum mechanics, basically. And those laws have some features that are not in our macroscopic world, because they get [laughs], they get washed out, they get destroyed. And we can prove this mathematically, basically.*

Because he said that this is his explanation assuming the person he is speaking to knows classical physics, I asked him how he would explain quantum physics without that assumption, and he said the following:

> *I would just start with basically saying that so in order to describe how things move, or describe how nature behaves, if you see a phenomena, any phenomena, you can point out like the why is the sky blue, anything like that. We have specific classical laws to describe it.... So any phenomena you can point out, we can describe it, and we can predict what's going to happen 100 years from now, or we can predict in a number of years. So the and that's the job of physics. So in order to understand phenomena that happened around us, why is the sun shining? And what is the temperature? What is, how do we feel hot? How do you feel cold? What, why do you feel, how do refrigerators work? All these kinds of things, we have specific classical laws of physics that can describe them, or that's the job of physics in general. And that's classical physics. So it's just describing what is classical physics and then*

> *basically saying that, well, all the objects that we have, are composed, will constitute, are composed of various molecules and small constituents that we call atoms. And it turns out after making experiments that these atoms actually disagree with everything that we thought was working in classical physics, so things don't have like a specific definite velocity. If you throw an atom, it's not gonna have like a specific velocity and position, which is very weird. It's not a concept that we are used to, a quantum mechanical atom. And basically, that's the job again, of quantum physics. So quantum physics is addressing this is addressing this by describing new laws of motion new laws that would describe phenomena in the microscopic world. And even though this is something that we don't see, it really affects big scale phenomenas.*

In other words, regardless of whether someone knows classical physics or not, Student A would require a mention of it to explain what quantum physics is. It is best to understand classical physics to understand the distinction that is established in quantum physics. I should understand that, in a classical world, my professor's pen will hit me so that I can understand that, in the quantum world, the same thing may not happen; I will not know what the pen does until I take a measurement based on laws in quantum physics.

Another way I saw linguistic and cultural frameworks providing a necessary foundation was through the classroom and research meeting dynamics. I have experience with undergraduate physics classes at UMBC and some undergraduate classmates of mine have experience with graduate physics classes. Also, I have experience with physics research, where my professor advised me on what to do and helped me interpret my findings to develop the next steps. The pattern of these interactions that I know very well, however, was not entirely present in my participant observation. In these new settings, the professor and students were always working together to help each other understand the topic at hand. In Professor 1's class, there was an equation from the textbook that the professor and students wanted to prove before moving on. Each person, including Professor 1, took turns attempting to prove it, and they even asked for my input on their work. Rather than the professor lecturing his students about the content the way a standard college class runs, there was a level ground between Professor 1 and his students. I saw this same collaborative dynamic in research meetings held by Professor 1 as well as those held by Professor 2, whom I also observed. In these meetings, students were expected to explain to the professors conceptually why their data appeared to be the way it did. I brought this unfamiliar dynamic up in my interview with Professor 1, to which he said the following:

I've gotten another couple of students right now, who are working towards their PhD on this, and they've all done really well, they published papers, they made contributions to the field, and the coolest part is that I've actually been able to learn from them in many cases. They would insist that you have to learn this this mathematical method or something and I think it'd be helpful. I'd say, I don't think so. I haven't used that before, right? This is, I don't want to have to learn something new, right? I'm just trying to get this project done. No, no, no, you really, I think you should look at this. I think it's going to be helpful for us. Then I learn it and I'm like, yeah, actually, this is a really good tool, and, or even even like programming stuff. Just insisting....since they're, they do more explaining, I think in our group meetings, right, they're explaining to me what they've done over the past week more so than me explaining to them what I want them to do in the next week. I think they spent the bulk of the time explaining, so yeah, there's certainly been times where I just didn't understand what they were trying to explain. It took me a long time to get it. I'm sure they could tell you that there are many times that that goes the other way too where I'm trying to explain something and it just doesn't click. It's more like a conversation, right? Like, I need to know what you're doing. And then we need to think out loud together about what you should be doing. And maybe I don't even figure it out during our conversation, right? Maybe we end up you've probably seen this happen once or twice, where it's just like, I don't understand what's going on here in these results, and I'm not sure what we need to do next so we'll talk about it next time, you know? Yeah, it's just, it's just real time processing in a lot of cases.

The collaborative, conversational structure Professors 1 and 2 used in their classes and research meetings allowed everyone involved to stay on the same page regarding their overall comprehension. When multiple linguistic and cultural frameworks were inevitably used to try to tackle or explain the same problem, it resulted in a better chance that everyone masters the subject matter they are facing. This is especially important for graduate students as they try to obtain the same level of understanding as the professors. Note that collaborative interactions are not exclusive to just quantum physics, but it is a significant pattern to recognize across these particular settings.

This dynamic helps provide a necessary foundation because our linguistic and cultural frameworks generally share similarities and overlap with one another, but there are also differences to account for. On one hand, my classmates and I collectively know what would happen if our professor threw a

pen in one's direction, but we have varying views on Wave-Particle Duality. Accounting for those differences ultimately provides more information to utilize; acknowledging the varying views on Wave-Particle Duality, although can result in conflicting ideas, also permits diverse perspectives on the theory in contrast to adhering to one view and disregarding the others. Having those diverse perspectives in mind is necessary for a field like quantum physics that is constantly evolving since members of the field need as much material to work with as possible. Furthermore, making space for every perspective present facilitates a mutual understanding of the topic at hand. As Professor 1 mentioned, his students insisting that he learn new mathematical and programming methods resulted not only in everyone eventually agreeing on the helpfulness of the methods, but also in the professor now having tools that he can use. In part, it is because the professor's students brought up their ideas and had their ideas implemented that they can contribute to the substantial growth quantum physics currently exhibits.

DISCUSSION AND CONCLUSION

Physics students and professors bring their own linguistic and cultural frameworks that describe their everyday lived experiences and intuitions when learning and researching quantum physics. These frameworks can create barriers to participating in the field, such as understanding new concepts and terms that are counterintuitive, using new mathematical analyses for said concepts and terms, and recognizing magic-like representations from popular culture. These form barriers because participants new to the field, faced with the difficulty of a subject they assume they simply are not good at, may overlook why it is difficult in the first place. However, some of these same frameworks provide a necessary foundation, as lived experiences create an intuition necessary for understanding classical physics which, in turn, is necessary for understanding quantum physics. Developing and building on that intuition is not something that can be ignored or skipped by a participant; it is essential within classical physics. Everyday lived experiences are also inevitable for everyone, making the process of developing an intuition inevitable as well as the barriers that unfold. These barriers, however, can be conquered; the success of current quantum physicists and the success of students taking quantum physics courses is proof. Collaborative learning and research environments implementing several frameworks at once also allow for overall comprehension.

The importance of this study comes from the relevance of quantum physics today. The field is very current and constantly evolving: quantum

physics explains what an MRI does (Griffiths and Schroeter 2018), quantum computers solve problems that regular, classical computers are not able to ("Quantum Computing"), and more. Quantum physics contributes substantially to science, technology, and everyday lives. If students become intimidated by quantum physics, however, their contributions may be minimized when the field should be expanding as much as possible. Understanding the barriers that come with learning and researching quantum physics can make the subject more approachable for students like myself so that they no longer believe that the difficulty of the subject is due to their lack of aptitude. It will also encourage professors to be more patient with students struggling with quantum physics and help them see areas where students may need assistance. Furthermore, recognizing the ways that linguistic and cultural frameworks shape the way that sciences are done and professionals are developed is required in fields outside of physics, with Mertz's (2007) study on law school and Davis-Floyd's (1992) study on medical school mentioned earlier being examples. The ideas covered in this study may shed light on those processes and limitations as well.

There is more work to be done in identifying the frameworks that students bring to their studies in physics and elsewhere as well as how the frameworks inhibit or benefit them. This exploratory study was limited by the project's time constraints, as well as my own experience with the material. There was a large difference in the amount of quantum physics knowledge that I had at the time I began and the knowledge that the graduate students had, so I spent much time reviewing some of the concepts they would mention during participant observation. This also affected the time I had available for this project. In addition, I would have liked to have been able to explore some of the aspects of the project further. For instance, one of Student A's research topics is quantum Darwinism, which he described as how classical physics has emerged in quantum physics. Elaborating on that topic could extend my idea of classical physics relying on one's intuition, and how intuition is necessary for understanding quantum physics directly.

All things considered, quantum physics is a difficult subject. Physics is already an interesting challenge, but quantum physics is a challenge within the challenge. While coming across the barriers that surface when learning and researching quantum physics, I could not help but ask why my participants chose to pursue such a field. They all had the same answer: quantum physics describes nature. Despite the difficulty of quantum physics and the barriers that show up, it is all outweighed by the reward of the subject describing the world around us.

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EDITOR AND DESIGNER BIOGRAPHIES

Oliver Santos has been honored to serve as the editor-in-chief for the UMBC Review's 25th issue. Oliver will be graduating in May 2024 with degrees in mathematics, English, and political science, as well as minors in Ancient Studies and Law and Justice and an Honors College certificate. After graduating, he plans to attend law school. As a member of the UMBC Review team, Oliver has been able to hone his skills reading and critiquing academic writing, and he is grateful for the opportunity to learn about fields outside his areas of study. Oliver would like to thank his fellow editors, Andrew Coulbourne and Parvata Kirthivasan for their time and effort. He would also like to thank the UMBC Review's graphic designer, Aidan Sobutka, for all his work designing and typesetting the journal. Finally, Oliver would like to thank the UMBC Review's advisors, Dr. April Householder, Dr. Molly Jones-Lewis, and Ms. Laura Schraven for their tireless support.

Andrew Coulbourne is serving as an associate editor for the UMBC Review's 25th issue. Andrew is Humanities Scholar and an English major on the Communications & Technology track, looking to graduate from UMBC in May 2026. Andrew is grateful to have been a part of putting together this issue, and is glad to have had the opportunity to apply his love for writing and his aspirations for a career in editing and publishing in this position. Andrew would like to thank his fellow editors, Oliver Santos and Parvata Kirthivasan, for their tireless work during a busy year for the UMBC Review. He would also like to applaud this year's graphic designer, Aidan Sobutka, for so beautifully and creatively tying the journal together. Andrew would also like to thank the UMBC Review faculty advisors, Dr. Molly Jones-Lewis, Dr. April Householder, and Ms. Laura Schraven, for their countless contributions.

Parvata Kirthivasan is serving as an associate editor for the UMBC Review's 25th issue. Parvata is a Sociology major with a minor in Gender and Womens Studies on the pre-law track, looking to graduate from UMBC in December 2025. Parvata has learned a lot about the academic writing process and all the hard work that comes with it and has been so grateful for the chance to learn from reading and handling academic papers pooled from UMBC's wide array of

undergraduate researchers spanning across disciplines. They would like to thank her fellow editors, Andrew Coulbourne and Oliver Santos, for all of their hard work and dedication to the Review. Parvata would also like to express their gratitude for the UMBC Review's graphic designer, Aidan Sobutka, who brought the journal to life with his creative vision. They also want to note that UMBC Review could not have been possible without the advice and support of Dr. April Householder, Dr. Molly Jones-Lewis, and Ms. Laura Schraven.

Aidan Sobutka had the pleasure of designing the 25th issue of the UMBC Review. Aidan is a graphic design major at UMBC and works at commonvision, UMBC's design and print center. On top of that, he pursues freelance orders and works with music artists to design their album art. Aidan is grateful to have the opportunity to work on this book for his university. With the organic, yet minimal visual language, he plays into the theme of processes, relating back to research. The lily flower, shown as a negative, ties into the film development process, relating to notions of steps, just as in a research journey. He has learned a lot about book design throughout this project and would like to extend his gratitude to his visual art advisor, Ms. Laura Schraven for her guidance and contributions. He wants to thank the editors, Oliver Santos, Andrew Coulbourne and Parvata Kirthivasan for their hard work. Aidan would also like to thank the UMBC Review faculty advisors, Dr. Molly Jones-Lewis and Dr. April Householder for their collaboration. Additionally, he would like to thank his roommates, Matthew Hambrecht and Patrick Holsonbake, for their feedback on the first initial test prints for the inside pages. Finally, he would like to shout out his sister Lilly Sobutka, his father David Sobutka, and his mother Susan Sobutka for their continuous support and encouragement.