|CURIEUX|

ACADEMIC JOURNAL

June Issue

Editing Staff

Chief-In-Editor

Caroline Xue

George Hasnah

Chief of Operations

Anshal Vyas

Assisting Editors

Olivia Li

Luzia Thomas

Madalyn Ramirez

Shefali Awasthi

Soumya Rai

Sarah Strick

Table Of Contents

Building an Inclusive Community: Redesigning Cafes Effectively to Improve Accessibility for People With Mobility Devices By Jisoo Choi

Introduction

There are numerous places for individuals to connect with one another apart from home and workplace settings. With an increasing popularity, cafes have now become an integral part of communities around the world. Cafes are considered a "third place" that holds significance as a way for people in communities to "unify" (Tjora and Scambler 11). Third places are areas where people come together and engage in a feeling of hospitality amongst themselves which is important to the development of a society. (Tjora and Scambler 20). Although cafes are known as a place of community among all people, those with mobility devices may often feel excluded due to limitations created by the design of the cafe.

Mobility device users are made up of people with a variety of disabilities such as circulatory, respiratory, and neurological disabilities ("ADA Requirements: Wheelchairs"). Accessibility devices range from assisted walkers equipment, wheelchairs, and manually power-driven devices ("Mobility Devices"). There are numerous different needs to be considered in the environment of mobility device users as they may use different types of devices depending on their physical limitations. Over 3 million American adults require a wheeled mobility device, meaning a significant amount of the U.S. population is affected by difficulties in their physical environment (Lagu et al. 441). Such limitations may hinder the navigational abilities of those with mobility devices through issues in the environment such as lack of space and lack of accessible ways of transportation to elevated areas (Kuboshima and McIntosh 13). Cafes as a place widely used by many, often do not satisfy these needs that those with disabilities need in their environment to feel welcomed and comfortable.

Inclusivity in cafes is not just to benefit individuals, but the community as a whole. Public spaces like cafés can benefit in many diverse ways whether it be by providing escape for individuals or a place of inter-ethnic social interactions (Cattell et al. 544). Public open spaces can bring benefits to one's well-being and bring communities together (Cattell et al. 544). Cafes are public spaces commonly also enjoyed by the elderly as a way to socialize and relax, and with the rise in the aging population, there may be an increase in the reliability of accessibility devices or other physical limitations. In addition,aAn environment inaccessible to mobility device users

may also impact cafe business unknowingly. It is therefore important to ensure that all members of the community including the physically disabled are considered when designing cafes, especially as they are an increasingly crucial part of the current population.

Kuboshima and McIntosh's study highlights the many physical environmental factors that mobility-impaired individuals who use walkers face in various settings. Although these problems are based on walker-users, these factors can apply to many other mobility device users due to their common wide frame that often causes problems. As stated earlier, cafes are a very significant part of the community. However, mobility device users experience several struggles ranging from the navigation of the physical environment to safely participate in areas similar to that of a cafe (Kuboshima and McIntosh 1-2). This paper aims to summarize and evaluate current research on design guidelines involving cafes for people with mobility devices. Moreover, the findings from the research are then used in this study to further propose, elaborate and suggest practical design guidelines for an inclusive cafe setting based on the needs of people with physical disabilities and limitations.

Entry and Exit

Wheeled walkers, an affordable mobility device used by many individuals with physical limitations may often have rear wheels that are non-rotatable. In order to turn themselves around, users must lift up the walker (Lindemann et al. 216). Studies have shown that those with wheeled mobility devices often avoid turning themselves around in an environment for fear of falling over due to their limited strength and the device's limited features (Kuboshima and McIntosh 5-6). By changing the layout of cafes to limit turning around, wheeled mobility device users can access all parts of the space open to them and will be able to move through areas with more comfort.

According to figure 1, there are 4 possible design solutions to address the concern. Firstly, creating two separate doors that people can enter and exit through would encourage traffic around the cafe to be more moderated. Secondly, having a single wide pathway (over 5 feet) where people can walk and access all parts of the cafe through it and having the seating be arranged with a space over 4 feet available which would allow enough area for wheeled walkers to move across the cafe with confidence. Moreover, if the exit is near the seating area, individuals with mobility devices can potentially exit more conveniently without turning. Despite the proposed solutions, there are certain drawbacks such as the need for a larger space and

confusion of entering and exiting the wrong way. The pathway will require a lot of room, especially near the area where people are ordering food as there may be a line. This can limit the space for people and the number of people who can be in the cafe. In spite of the signs, people may still choose to enter and exit according to their own judgment and purpose.

Figure 1 highlights the importance of creating suitable entry and exists to limit turning for those with walkers or other physical devices
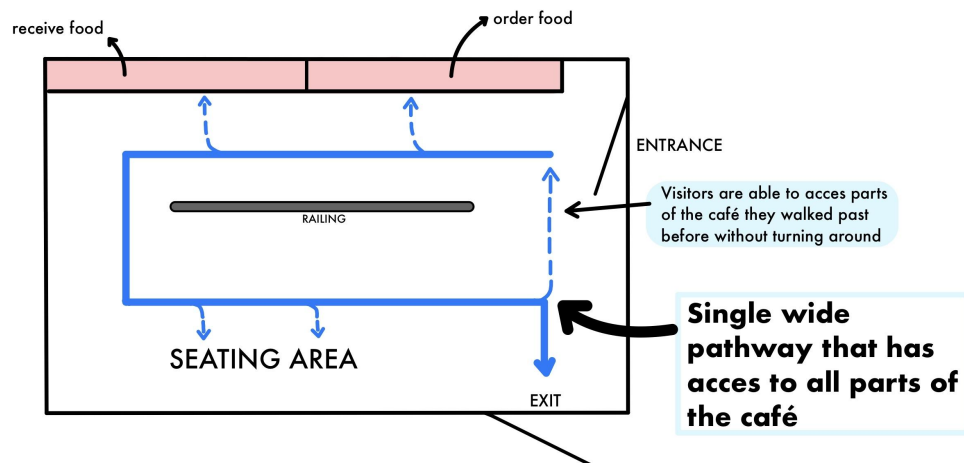
Space Availability

It is also important to consider the seating arrangement in a cafe. Since most cafes have limited space, seating should be kept to approximately 30% of space available to maintain a moderate density. Lower to moderate levels of seating density are preferred in a crowded cafe environment (Yildirim and Akalin 3410). In this study, moderate seating is described as a 38/128 m2 ratio of furnished area to the entire area of the cafe (Yildrim and Akalin 3416). Lower seating density can also benefit the mobility and navigation of an area for mobility disabled individuals. A design inclusive of those in use of mobility devices requires at least 800 millimeters of space in between seating areas and at least 1.2 meters of space next to the tables as shown in figure 2 (Kuboshima and McIntosh 10). Having a lower seating density will clear up more space for the mobility disabled and benefit the experience of individuals in the area.

Figure 2 describes the optimum level of spacing of the seating area in a cafe
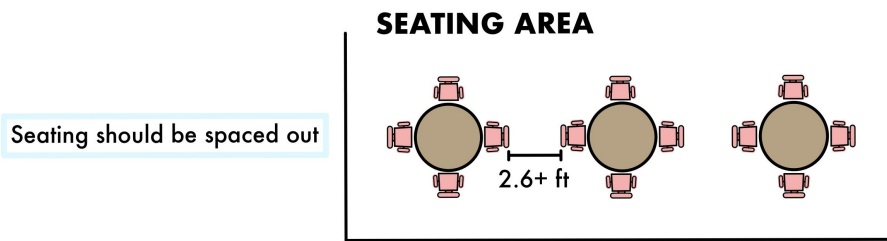
User Friendly and Adjustable Furniture

Tradeoffs created from the issue of limited space can also be mitigated by using more accessible furniture. For the best comfort of those with mobility impairments, the furniture should go beyond its regular functions and be adjustable as demonstrated in figure 3. Non-adjustable furniture was shown to cause issues for the mobility impaired such as improper posture (Tanure and Okimoto 542). Some cafes may decide to adopt both circular and square tables. A simple decision to choose tables that are round can make it more accessible to people with mobility devices.

As shown in figure 4, the surface area can be greatly reduced by simply adjusting for circular tables. With the same amount of space, cafes adopting this strategy can benefit from having more space and a less crowded environment. This may provide more personal control which will help individuals feel less distracted by their environment (Lee and Brand 324). By adding more adjustable features to an environment, it can help satisfy the varying needs of the customers to relax. In fact, it may even be welcomed by individuals without mobility devices. Although having adjustable furniture may be more costly, it can provide a user-friendly experience to a wider population including people without mobility devices.

Figure 3 shows the prototype of adjustable furniture

Users can turn a wheel for height adjustment

Furniture that can be adjusted by the user
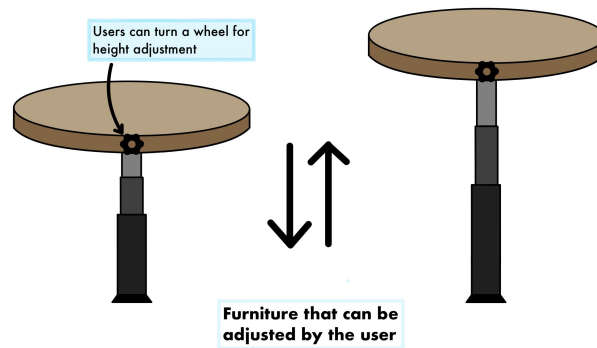
Figure 4 indicates the space density of a squared vs a circular table

SQUARE TABLE

ROUND TABLE

missing corner space

A circular table has less surface area due to its missing corners
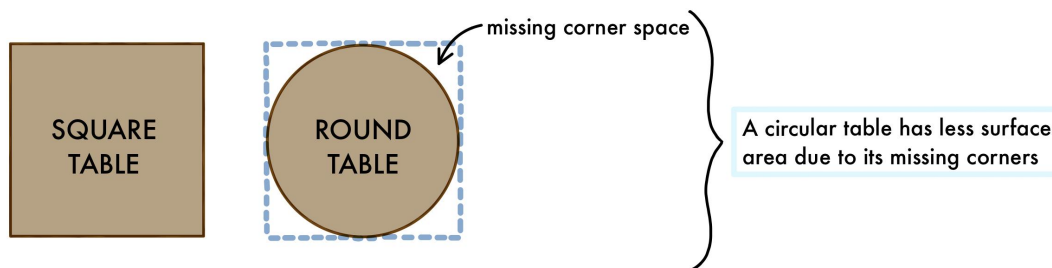
Door Accessibility

A common struggle that many physically disabled members find in their daily environment is level differences preventing them from accessing a space (Wennberg et al. 467-468). Hinged doors have been shown to cause many wheeled mobility device users struggles in opening them and moving through them in a safe and efficient way (Kuboshima and McIntosh 4-5; 7-8). Kuboshima & McIntosh's study demonstrates how participants found hinged doors to be hard to maneuver due to a slight level difference at the bottom of doors and the heavy features of the doors that also causes a high risk of injury if the door were to swing into them (4-5; 7-8). Therefore, it is essential to consider altering the traditionally designed doors to new innovative designs.

A few systematic solutions to increasing accessibility in entrance of the cafes would be opening doors by pressing a button or having automatic sensors underneath the entrance and providing sliding doors that have no level difference at the bottom of the door as mentioned in figure 5. There can be concerns of relying on technology for the door to open as being risky as

the system may be prone to malfunctions. An additional concern would be that sliding doors are significantly more costly due to the extra materials and technology required. In addition, the increasing costs are a major drawback to increasing accessibility. In such cases, some cafes adopt having no doors during business hours especially if it is located in an indoor recreational setting or shopping malls which may lower the cost of running a cafe.

Figure 5 demonstrates the proposed guideline of increasing door accessibility
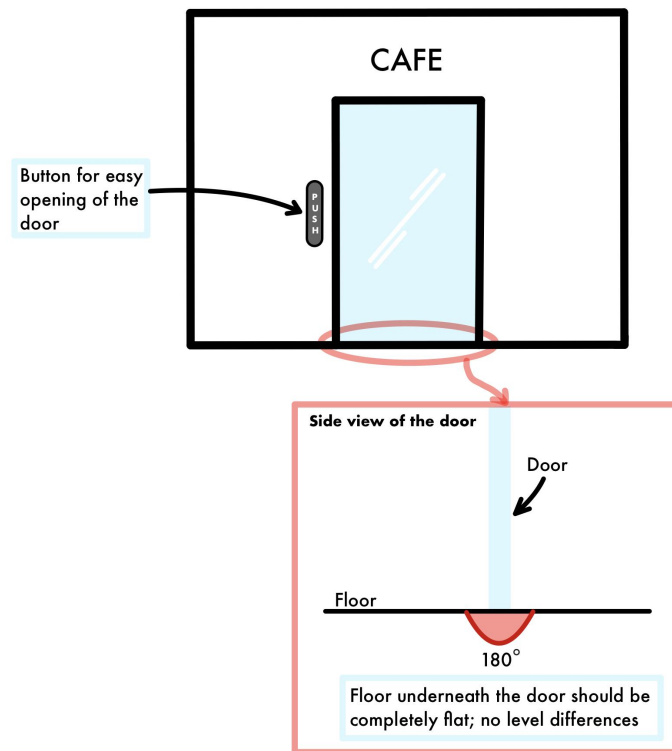
Elevated Pathway

The location of a cafe may be essential for accessibility concerns. A number of cafes are located in an uphill location which could make it difficult for people with mobility devices to access it. A study on those with wheeled mobility devices showed that they struggle to even go over a small level difference at the door in fear of falling over, let alone the stairs (Kuboshima & McIntosh 7-8). Due to these issues, alternative ways of transporting to elevated spaces should be implemented. A design idea for entrances and exits, shown in figure 6, could be to provide a ramp with a maximum 4.8-degree angle that goes to elevated spaces instead of stairs and handrails next to the ramps to provide support. Although it increases accessibility, individuals

may be more likely to slip especially if it is wet or not properly maintained. In addition, more outdoor space would be necessary for the proposed ramp to be built. On the contrary, having ramps can also be considered when relocating to another place to reduce the costs of designing one.

Figure 6 describes the optimal level of the ramp at the maximum degree of 4.8
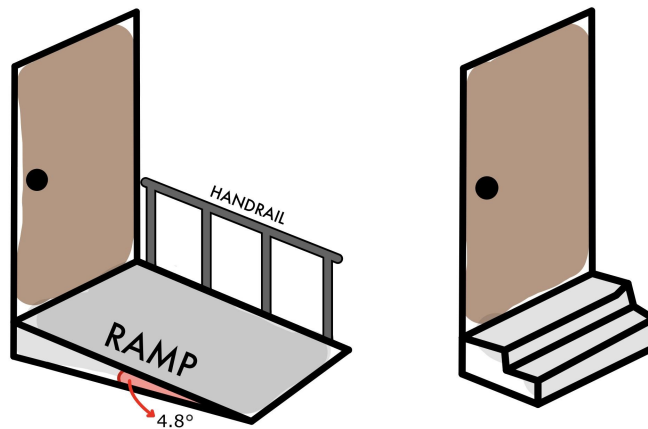
Accessible Washroom

As cafe's are also considered a "third place" for work these days, mobility device users may use it as a coworking space and essentially require accessible washrooms. The lack of space and materials normally provided in a cafe could be exclusive to allowing those with physical disabilities in a comfortable and safe manner. Many of those with physical disabilities are elderly and need assistance in doing certain tasks like going to the washroom.

Providing non-gender-specific bathrooms that can also just be used as family rooms can make it less uncomfortable for users who may need assistance to go to the washroom (Pantzartzis et al. 28). Water spills and slippery floors are unavoidable in a bathroom setting but can also be an extreme tripping hazard to those with physical disabilities. To ensure that if this does happen, help can be brought to the user right away, an emergency call button should be implemented in each of the washroom stalls. Having an accessible washroom may not require additional space as cafes can operate functionally with just one washroom. Designing the washroom to be accessible is all that is necessary to be inclusive of everyone.

Conclusion

        Cafes have been shown to play an essential role in a community as a "third place" (Tjora and Scambler 7-12). However, there are still differences that must be considered. This research paper is centered around creating an environment to increase accessibility for people with mobility issues. The importance of building a comfortable social atmosphere is also addressed in this paper through guidelines. Existing research on the physically impaired is predominantly on larger and open environments such as parks, transportations or even homes (Kuboshima and McIntosh; Atoyebi et al. 223). Accessibility in cafes is largely unexplored and understudied in academia.

        Furthermore, cafes are much smaller and more populated spaces. Using the information from previous studies about struggles in a larger, less populated environment, the different types of problems faced by individuals who may rely on accessibility devices found to be relevant to cafes. The existing research from open environments has been used to create new, innovative guidelines regarding cafes. The suggested design guidelines may further the understanding of cafes and how to develop appropriate designs that are inclusive of the physically disabled.

        There are several limitations to this study. The major limitation is lack of available research on how those with mobility devices interact in third places, especially cafes. This lack of available information resulted in most of the guidelines being based on research centered around other environments. It should also be considered that there is not enough research to back the effectiveness of these guidelines. Currently there is no practical example of how these designs can benefit people with accessibility devices. Therefore, it may be essential to empirically test these design guidelines to support the hypothesis that it may be beneficial to people with accessibility devices.

        It may also be important to consider the advancement of technology and its impact on reducing possible tradeoffs such as cost, space and lack of materials in cafe settings. Unique and innovative designs with technological development may elevate the guidelines proposed and promote more cost effective solutions for cafe businesses. Furthermore, more studies should be done on how smaller third places such as cafes may affect individuals with other neurological and physical disabilities. As future studies start putting their focus on third places, cafes can start to be more accessible to all members of the community.

Works Cited

Atoyebi, Oladele A., et al. "Mobility challenges among older adult mobility device users." *Current Geriatrics Reports* 8 (2019): 223-231.

"ADA Requirements: Wheelchairs, Mobility Aids, and Other Power-Driven Mobility Devices." *ADA.gov*, ADA Compliance, https://www.ada.gov/resources/opdmds/.

Cattell, Vicky, et al. "Mingling, Observing, and Lingering: Everyday Public Spaces and Their Implications for Well-Being and Social Relations." *Health & Place*, vol. 14, no. 3, Sept. 2008, pp. 544–561., https://doi.org/10.1016/j.healthplace.2007.10.007.

Kuboshima, Yukiko, and Jacqueline McIntosh. "Housing design that improves the independence and safety for older adults using a walker." *Applied Ergonomics* 97 (2021): 103539.

Lagu, Tara, et al. "Access to subspecialty care for patients with mobility impairment: a survey." *Annals of Internal Medicine* 158.6 (2013): 441-446.

Lee, So Young, and J. L. Brand. "Can personal control over the physical environment ease distractions in office workplaces?." *Ergonomics* 53.3 (2010): 324-335.

Lindemann, Ulrich, et al. "Problems of older persons using a wheeled walker." *Aging clinical and experimental research* 28 (2016): 215-220.

"Mobility Devices." *ADA.gov*, ADA Compliance, https://www.ada.gov/topics/mobility-devices/.

Pantzartzis, Efthimia, and Andrew Price. "Health Building Note 08-02: dementia-friendly health and social care environments [Powerpoint presentation]."

Tanure, Raffaela Leane Zenni, and Maria Lúcia Leite Ribeiro Okimoto. "Requirements' Literature Review for the Development of Furniture for People with Motor Impairments." Advances in Ergonomics in Design: Proceedings of the AHFE 2017 International Conference on Ergonomics in Design, July 17− 21, 2017, The Westin Bonaventure Hotel, Los Angeles, California, USA 8. Springer International Publishing, 2018.

Tjora, Aksel, and Graham Scambler, eds. *Café society*. New York: Palgrave Macmillan, 2013.

Wennberg, Hanna, Christer Hydén, and Agneta Ståhl. "Barrier-free outdoor environments: Older peoples' perceptions before and after implementation of legislative directives." *Transport policy* 17.6 (2010): 464-474.

Chasing Clicks By Legend Yang

The world seems to be spiraling down a hole of troubles and controversies. Stories about war, crime, and drug abuse fill our news feeds and make the hole seem like it is getting bigger and bigger. However, the world is not getting worse, as the journalists portray. Instead, journalists carefully select stories that have shock value and will generate a large number of clicks, which means the stories are typically negative. These clicks certainly help the news corporations stay afloat and the journalists pay their bills; however, chasing clicks with negative stories rather than covering all newsworthy events has detrimental effects on everybody else.

As the world gets more developed and technology more widespread, a new type of journalism has emerged. News is more accessible, as people can simply look at their phones for the latest updates(Mathew). This also means that there are more articles posted than ever before with millions of articles on a single topic. This has caused journalism to become increasingly competitive as it can be hard for an article to stand out from the others. To fight for your attention, journalists are forced to implement new techniques to get you to click on their stories; otherwise, many would find themselves out of work.

To adapt and keep up with the fast-paced and competitive world of technology, journalists are unintentionally causing the spread of misinformation. This is because more and more readers don't have the time or patience to read lengthy news articles(Mathew). Instead, they only read the title or a few lines of the articles to gain general information about the topic. They form an opinion without knowing the full story and the multiple layers that could be involved, thus spreading misinformation. In response, Journalists have started to exaggerate the titles and opening lines of their news articles to gain the attention of this new type of reader. This "sensationalism' has helped coin the term "clickbait", and it is misleading audiences more than ever because social media allows more posts than ever(Frampton). To exacerbate the problem, a report by Angèle Christin highlights the fact that writers get paid $5 for every 500 clicks on their stories. This incentive is simply too high for journalists to ignore with more than 3,000 sites using Chartbeat, an analytic program, to help journalists maximize their clicks(Christin). Modern journalism changes its focus to chasing clicks rather than spreading useful information to benefit its bottom line and pockets.

In addition to sensationalizing stories to entice more clicks, journalists tend to only cover controversial and negative news to maximize their profits. Humans are drawn to negative stories (especially those which are sensationalized) because of the "negativity bias" our brains have(Jarrett). A new study involving more than 1,000 people across seventeen countries suggests that people pay more attention to negative news than to positive news(Khan). Humans even recognize negative words faster than positive words and can even predict unpleasant connotations before knowing what a word means(Stafford). Thus, when we see something negative on the internet, we are more drawn to it than when we see something positive—which is rare, to begin with. When we start clicking on the more negative news, we start seeing more of those types of articles on our social media pages and in our Google search results. We continue to click on more negative news, reinforcing the negative cycle. Over time. Pretty soon, our reality is skewed because we are seeing stories based on our algorithm, causing a misrepresentation of the truth.

Let's examine a specific example that illustrates this phenomenon: On 15 April 2013, two bombs exploded at the Boston Marathon. Three people were killed that day, and hundreds were injured("*Three people killed*"). The people who had seen the bombing in person suffered mental health issues afterward. However, another group of people also suffered. Those who had not seen the explosion in person but had consistently watched the news coverage in the week afterward(Castillo). The news over coverage of the topic caused many people to fear the chance of recurrence. This created a false picture of the society we live in today as the bombing is not as terrible as the journalist portrays it. This causes citizens to enter a negative spiral called "doom scrolling," which causes more anxiety as they don't know that the events reported are rare occurrences(Thakur). Maybe mental health wouldn't be such a problem today if journalists would balance their coverage.

As more and more people are misled, collective illusion occurs. Collective inclusion is defined as a situation where most people in a group go along with an idea that they do not agree with simply because they think that most people in the group agree with it(Chatfield). However, reality suggests that close to 80% of all content on social media is generated by about 10% of the users(Chatfield). These 10% just happen to be the ones that have the most radical perspectives on social issues. As a result, the entire group ends up doing things that almost nobody wants. This is becoming more common as journalists chase clicks. Many people become intrigued by the

extreme events being posted and sensationalized, which creates more clicks. This will eventually lead to a large group of citizens who do not know that many don't believe what they think is true: misinformation.

A misguided vortex of skewed information is not the only issue caused by the chasing of clicks. An angry and divided population is another major effect of today's journalism. Many journalists only write about scandals, and public takedowns, due to their controversial nature(Popkin). These types of stories create angry arguments as the average citizen will often tweet about their vexing grievances, bringing more attention to the stories and compelling their followers to click on the stories. Bonus attention for journalists and revenue for the publication. Journalists revel in this attention and despite the moral implications will devote even more attention to the hot topic. The global conversation becomes even more heated arguments, causing the political rift we see in society today(Popkin). Perhaps we would all get along better if journalists would curtail the over-reporting of insignificant negative events.

The bonus, however, does not fall solely upon journalists, who, it could be argued, are just doing their jobs. What about the social networks themselves? Social networks such as Facebook are using software to determine which type of posts get the most views and prioritize those stories. They pay journalists directly for the revenue the clicks bring in on their networks to encourage more publication of those types of stories(Wagner). And the vicious cycle continues. The power of Facebook, Instagram, Twitter, Google, etc, control the content delivered on their platform forcing journalists to conform, whether we agree with the practice or not. Social media conglomerates are the main problem in our society today.

Modern Journalists and social network companies are not doing their jobs of spreading a wide range of information to the public to increase awareness of the true and real world we live in today. Instead, they are only focusing on reputations and revenue. But you are not helpless, mere citizens, no. We can all do our part by no longer clicking on provocative articles. This will force better journalism and promote a more informed social media and the public that can hopefully just all get along.

Works Cited

Castillo, Michelle. "Watching coverage of traumatic events may cause high stress." *CBS News*,
10 December 2013,
https://www.cbsnews.com/news/watching-coverage-tramatic-events-boston-marathon-str
ess/. Accessed 27 March 2023.

Chatfield, Jason. "Home." *YouTube*, 11 April 2019,
https://jasonchatfield.medium.com/what-are-collective-illusions-and-how-do-they-form-b
d4910fa576a. Accessed 26 March 2023.

Christin, Angèle, et al. "When it comes to chasing clicks, journalists say one thing but feel
pressure to do another." *Nieman Lab*, 28 August 2014,
https://www.niemanlab.org/2014/08/when-it-comes-to-chasing-clicks-journalists-say-one
-thing-but-feel-pressure-to-do-another/. Accessed 20 February 2023.

Frampton, Ben. "Clickbait: The changing face of online journalism." *BBC*, 14 September 2015,
https://www.bbc.com/news/uk-wales-34213693. Accessed 26 March 2023.

Jarrett, Christian. "Why do news reports always begin with bad news?" *BBC Science Focus
Magazine*,
https://www.sciencefocus.com/science/why-do-news-reports-always-begin-with-bad-new
s/. Accessed 20 February 2023.

Khan, Amina. "Why does so much news seem negative? Human attention may be to blame." *Los
Angeles Times*, 5 September 2019,
https://www.latimes.com/science/story/2019-09-05/why-people-respond-to-negative-new
s. Accessed 26 March 2023.

Mathew, Daniel. "The Role of Social Media in Journalism." *Hilaris*,
https://www.hilarispublisher.com/open-access/the-role-of-social-media-in-journalism-871
20.html. Accessed 26 March 2023.

Popkin, Helen AS. "As your social media emotions go viral, anger spreads the fastest." *NBC
News*, 17 September 2013,
https://www.nbcnews.com/technolog/your-social-media-emotions-go-viral-anger-spreads
-fastest-4b11186087. Accessed 20 February 2023.

Stafford, Tom. "Psychology: Why bad news dominates the headlines." *BBC*, 29 July 2014,
https://www.bbc.com/future/article/20140728-why-is-all-the-news-bad. Accessed 26
March 2023.

Thakur, Jyoti. "Explained: What Is Doomscrolling And What Goes Behind People's Obsession
With Negative News." *Indiatimes.com*, 28 January 2022,
https://www.indiatimes.com/explainers/news/what-is-doomscrolling-explainer-560472.ht
ml. Accessed 27 March 2023.

Three people killed, hundreds injured in Boston Marathon bombing,
https://www.history.com/this-day-in-history/three-people-killed-hundreds-injured-in-bost
on-marathon-bombing. Accessed 27 March 2023.

Wagner, Kurt. "Three Major Ways Social Media Is Changing Journalism." *Santa Clara
University*, 22 March 2017,
https://www.scu.edu/illuminate/thought-leaders/kurt-wagner-12/three-major-ways-social-
media-is-changing-journalism.html. Accessed 26 March 2023.

The Cutting Room Floor of *A Raisin in the Sun* By Kevin Chen

The American Dream has long been regarded as the epitome of justice, equality, and democracy. Whether it comes in the form of smiling, picture-perfect families or heroic stories of rags to riches, for many, this vision is forever out of reach. Lorraine Hansberry's 1959 play *A Raisin in the Sun* depicts this struggle with the Youngers, a multigenerational African-American family residing in the diverse South Side neighborhood of Chicago. Throughout the text, the Youngers face systemic obstacles surrounding their ambitions, many of which, although significant, may be subtle to readers. Yet, several renditions of the play eliminate entire scenes dedicated to portraying these barriers. While these cuts are seemingly insubstantial, they disregard Hansberry's views on various social injustices and vastly alter the scope of the text.

Of several major adaptations of *A Raisin in the Sun*, only the 1989 rendition retains the character of Mrs. Wilhemenia Othella Johnson, a nosy neighbor at the Youngers' new residence who foreshadows conflicting perspectives regarding acculturation and the hardships of living in segregated neighborhoods. As Mrs. Johnson speaks with Lena Younger, the family matriarch, and Ruth Younger, Lena's exhausted daughter-in-law, Mrs. Johnson refers to Booker T. Washington as an admirable historical figure. Lena immediately disagrees, sparking tension between the two. After Mrs. Johnson's departure, Beneatha Younger, Lena's liberated daughter, remarks that, "if there are two things we, as a people, [must] overcome, one is the Klu Klux Klan[,] and the other is Mrs. Johnson" (Hansberry 104). Beneatha's explicit parallel between Washington, an African-American leader viewed by some as an assimilationist, to the Klu Klux Klan, a hateful organization terrorizing African-Americans for centuries, is a compelling and startling comparison. Although Washington and the Klu Klux Klan are seen as tremendously contrasting figures, juxtaposing them draws attention to Hansberry's stance that cultural assimilation, a frequently overlooked issue in the United States, is comparable to conspicuous racism. Removing Mrs. Johnson's appearance subsequently eliminates this notion. Furthermore, Mrs. Johnson serves an additional purpose of informing the Youngers that people of color in Clybourne Park, a segregated neighborhood the Youngers are moving to, face harsh retaliation from their neighbors. She summarizes newspaper headlines, asking Lena whether she had "read [a]bout colored people [who were] bombed out their place" (Hansberry 100). Without this scene, readers are neither able to understand the danger nor the severity of the issue. Many disturbing

aspects are also eliminated, propelling the concept of a historically just society. Redacting these components alters major themes regarding race, subsequently stifling Hansberry's views on the topic of assimilation.

The 1989 film is also the only rendition of the play with scenes surrounding Beneatha's hairstyle, a recurring symbol in the play. Throughout the text, hair is a distinct symbol of defiance, as African-Americans have long embraced natural hairstyles as a form of resistance. Removing the scenes with Beneatha's internal conflict concerning her hair removes the textual opposition to acculturation. When Joseph Asagai, Beneatha's college acquaintance, gifts her a Nigerian robe, she delightfully drapes it onto herself. Asagai then makes an abrupt comment about her hairstyle, questioning her motives behind straightening her hair, to which Beneatha exclaims, "it [is] so hard to manage when it [is]... raw" (Hansberry 61). Asagai refutes this, claiming that "[a]ssimilationism is so popular in [America]" (Hansberry 62). His statement convinces Beneatha to cease the maintenance of her straightened hair, cutting it to reveal her natural hair. This physical representation of defiance against cultural assimilation underscores the struggles many African-Americans face. Although natural hair is a form of cultural pride, the perception that natural hair is unprofessional suppresses many from donning such hairstyles. Hansberry crafted Asagai's role to label these unfair hairstyle expectations as acculturation, so when scenes involving Beneatha's resistance are cut, Hansberry's message is removed as well. Act II introduces George Murchinson, a wealthy suitor who Beneatha despises. As George arrives at the Youngers' apartment, Beneatha "lifts her hands and pulls off the headdress", unveiling her new hairstyle (Hansberry 80). George remarks that "being eccentric means being natural" (Hansberry 80), to which Beneatha replies, "I do [not] like that, George" (Hansberry 80). The significance of this scene comes in the power behind Beneatha's rebuttal. As she reclaims her culture, she is more empowered to defy societal norms reinforcing acculturation. Omitting this segment disregards Hansberry's concept of power behind resistance – without this message, society is less compelled to act. It is evident that cutting these segments undermines the substantial strength and support behind greater social movements opposing cultural assimilation.

Most major productions of *A Raisin in the Sun* exclude two notable scenes featuring Travis Younger, Ruth's youthful 10-year-old son, who displays immense maturity around the insidious impacts of financial instability on the family. Removing these scenes obscures the audience's perception of the magnitude of economic struggles concerning the Youngers. Prior to

his departure for school, Travis reveals to Walter Lee Younger, his father, that Ruth "wo[uld not give him] fifty cents", to which Walter Lee responds by "[r]eaching down into his pants with a rather important gesture", giving a dollar to Travis (Hansberry 30-31). Ruth then glares at Walter Lee with "violent rays" (Hansberry 31). This glare illustrates the fact that although fifty cents, the equivalent to five dollars in modern-day society, may appear negligible to others, it is still difficult for the family to afford. Despite the fact that Hansberry touches on the Youngers' financial struggles in the introduction, readers are not familiar with the sheer gravity of the situation, hence they cannot sympathize with the family without this scene. As the Youngers share financial worries regarding a newborn to the family, Beneatha notices Travis chasing a rat outside and asks him to return to the Youngers' apartment immediately. Once Travis returns, he is "excited and full of narrative", exclaiming that his family "should [have] seen the rat[, as it was as b]ig as a cat", followed with other gruesome details (Hansberry 58). Beneatha then immediately directs Travis away as the rest of the family expresses their horror. The Youngers' economic struggles become especially evident in this scene, as Travis, the embodiment of an innocent child, must resort to playing with a rat, a symbol of squalor. Excluding this portion limits the comprehension of the Youngers' struggle with poverty, further dulling Hansberry's views regarding the impacts of financial instability. Given Travis' significance to the text, audiences cannot understand the contents of the play when these acts are removed.

Omitted scenes from Lorraine Hansberry's *A Raisin in the Sun* have massive implications on the context of the play, with their removal disregarding much of Hansberry's craft and message. Controversial, but critical, civic issues impacting African-Americans are fundamental to most excluded parts of the text, with resistance being a major theme across removed sections. From hairstyles to rats, such precise, evocative details combine to configure large-scale messages surrounding the internal conflicts, cultural assimilation, and economic struggles the Youngers face. Leaving these sections on the cutting room floor attempts to mute literature addressing crucial societal matters, but evaded issues will not *dry up like a raisin in the sun*. Until society addresses systemic barriers oppressing African-Americans, the American Dream will continue to bear its stain.

Works Cited

Bero, Tayo. "Tangled Roots: Decoding the History of Black Hair | CBC Radio." CBC News,

      15 Oct. 2021, www.cbc.ca/radio/ideas/tangled-roots-decoding-the-history-of-black-hair.

Farber, Stephen. \`*Raisin*\` *Film to Include Scenes That Were Cut*. Chicago Tribune, 8 Aug. 2021,

      www.chicagotribune.com/news/ct-xpm-1988-09-08-8801280729-story.

Hansberry, Lorraine. *A Raisin in the Sun*. Penguin Random House, 1959.

Norwood, Candice. *The Legacy of Booker T. Washington Revisited*. NPR, 5 Mar. 2015,

      www.npr.org/sections/ed/2015/03/05/3884//the-legacy-of-booker-t-washington-revisited.

Taylor, Jenny. *A Raisin in the Sun*. San Joaquin Delta College, 12 Mar. 2018,

      deltacollege.edu/student-life/student-media/delta-winds/2010-table-contents/raisin-sun.

Andreas Vesalius: What Made Him So Great? By Haley Kim

Imagine this: a bright red rose blooms in a garden, its pigment striking and elegant against the brown-black dirt. To most, that's all there is to the flower. But they are deceived - they overlook the thorns hiding underneath the guise of the soft petals, they overlook the hours of watering, tending, and trimming that was necessary to bring the rose to an alive and pigmented state of being. The petals of the flower itself hold little value in comparison. When we take a look at the work of Flemish anatomist Andreas Vesalius, we can see a similar image. Blinded by the multitude of achievements and titles surrounding the anatomist's name (the petals), most fail to recognize that Vesalius' discoveries overshadow the process in which those discoveries were uncovered. Vesalius' achievements were surprisingly insignificant compared to the impact his methods and process had on medicine and anatomy. Born in 1514 in Brussels (modern day Belgium), Andreas Vesalius spent his childhood under the influence of his family of physicians and pharmacists. Some may say that Vesalius' early exposure to medicine is what later fueled his desire to seek the truth behind medical myths. After becoming a professor of surgery and anatomy at the young age of 23 at the University of Padua, Vesalius began his journey of revolutionizing the study of anatomy. During his time as a professor and anatomist, Andreas Vesalius was able to make incredibly significant claims criticizing the work of the ancient Greek physician, Galen. The works of Galen were widely accepted during the fourteenth century, and Vesalius himself was trained in anatomy from Galen's theories. So how exactly was Vesalius able to pinpoint the flaws in the work of someone so revered and established? And why was Vesalius' process so much more crucial to the future of anatomy compared to his results? Most know him for his accomplishments, and few know him for his research process and methods. But what truly made Andreas Vesalius so revolutionary in the field of medicine was not his achievements and successes, but his ability to break down old, outdated, and parasitic medical traditions.

Firstly, it is important to recognize that Andreas Vesalius' discoveries regarding the theories of Galen were purely the byproduct of his revolutionizing of systematic medical lectures. Traditionally, lectures regarding anatomy would proceed with a professor reading off of a text as a surgeon or paid sector would dissect the cadaver. Thus, there would be no need for the professor or the students to contribute to the dissection at any point during the lecture. (Wilson,

36-38) Such practice tended to result in a lack of firsthand experience and a limited understanding of various bodily functions for medical students. Not being able to experience, practice, and repeat procedures first hand heavily impacted rising medical professionals, and the lack of exploration caused research to become stagnant. No one had the means for making new discoveries, and everyone put every ounce of their trust fully in Galenic anatomy. Understanding that the current systems were lacking and imposing unreasonable medical ideals upon students and professors alike, Vesalius insisted on performing all of his dissections himself. (Scarborough, 8-9) However, Vesalius' strategy was initially viewed as slightly cliché, unusual and unnecessary by many of his colleagues. Because why would one need to further explore the human body when all that needed to be said was already stated, in Galenic anatomy? Vesalius was even met with an outrage from a shocked audience at the University of Bologna when he began to dissect a human cadaver in the lecture room in 1544. (Byrne, 43-45) Paying little regard to the word of others, Vesalius continued to push his own agenda. As onlookers looking back into history, we must recognize that had Vesalius not adopted this novel, innovative method he would have never stumbled upon the myriad of shortcomings that stemmed from the Greek physician Galen's flawed method of research.

It is necessary to note that Vesalius never intended to seek the impurities in Galen's theories. After all, Galen was a highly revered and trusted physician and researcher at the time, and Vesalius did not begin studying surgery and anatomy to pursue anything of the sort. (Britannica, 28-30) However, through the utilization of his new strategy, which was based on the belief that hands-on experience was key to harnessing the secrets of anatomy, Vesalius was able to pinpoint a multitude of errors in Galen's claims. Vesalius eventually came to the conclusion that Galenic anatomy was in fact not based on dissections of any human corpse at all. Due to strict religious restrictions in Rome during Galen's time of practice, medical professionals were prohibited from dissecting the remains of humans. Thus, Galen resorted to formulating his theories off of what he could observe from animals. (Wilson, 29-32) Galen was an avid dissector of pigs, monkeys, and dogs, and decided to use his knowledge and observations of these animals to arrogantly publish a textbook in the name of the human body. (Britannica, 44-46) Andreas Vesalius was one of the only anatomists at the time who had the means to come across such a truth as he was one of the only medical professionals actively dissecting and observing human cadavers. To provide an example of one of the many Galenic theories that were revealed to be

anything other than the truth, Vesalius critiqued and corrected Galen's description of the sternum, or breastbone. (Scarborough, 16) But again, it was not these discoveries that opened the door for a myriad of medical professionals to come. In fact, any other anatomist, researcher, or surgeon could have made these discoveries after Vesalius' time with ease. It is hardly anything special that Vesalius made a few observations on the structure of the human body - people have been doing so and will be doing so for centuries. It is the very fact that Vesalius was the one to tear down unrealistic medical traditions, medical traditions which restricted those in the medical field from expanding their knowledge, that makes his legacy significant.

Another instance of the outcome overshadowing process is seen when observing what is known to many as one of Vesalius' greatest accomplishments: *the Fabrica. The Fabrica,* also known as *De humani corporis fabrica libri septem*, is an anatomical textbook created by Vesalius, containing all of his observations and theories. *The Fabrica* depicts some of the first accurate descriptions of small bones, and portrays detailed, colorful diagrams and images for the reader's enhanced comprehension. (Scarborough, 21) Such a book became the blueprint for countless more medical textbooks in the future, due to its innovative, effective structure and format. However, *the Fabrica* itself is not exactly "a great book" if one were to look at it in retrospect. (Haggard, 72) There are countless other more accurate, more captivating textbooks that outdo the work of Andreas Vesalius. So why is *the Fabrica* viewed as the "greatest anatomical textbook" and not some other, more scientifically accurate textbook? Why is *the Fabrica* the one that will be forever revered in history? This is likely due to the fact that almost all medical textbooks during Vesalius' time were based on Galenic anatomy. They were also very bland. Medical textbooks were not only based on flawed research, but they also contained no images, as not one person had considered the significance of imagery and diagrams for an amplified comprehension. It is impossible to deny that structure that Vesalius chose to utilize in order to create this book was truly revolutionizing and unique. So much so that the vast majority of modern day anatomical textbooks closely shadow that of *the Fabrica.* But, they follow in the footsteps of *the Fabrica* not because Vesalius' discoveries were *that* thought provoking, but because the structure of his textbook was one of the first to defy traditional techniques. Writer Howard W. Haggard reinforces this thought in the *Journal of the Washington Academy of Sciences.* He writes, "His [Vesalius'] greatness and it/s [*the Fabrica's*] are not in their intended purposes and ends, but in their influence in breaking down a tradition that forced an unreality on

human thought - not alone in anatomy but in all medical thought." (Haggard, 73) Again, it was not the final outcome that impacted generations of medical curricula to come. It was the structure of the book, and the process with which it was created that revolutionized medicine and anatomy.

As spectators to history, it is important for us to note that yes, Andreas Vesalius' discoveries were in fact significant to anatomy and surgery. It's difficult to say that such discoveries were insignificant, as they did positively impact anatomy and surgery. However, what is more outstanding about Vesalius' legacy is that he was able to alter the process in which discoveries were made, therefore opening the door for a vast number of other anatomical theories to be developed after his time. Andreas Vesalius reworked the trajectory of anatomy and medicine for those in the medical field by conveying the importance of hands-on experience, practice, and repetition. He stepped out of the box that was the "status quo" amongst 14th century anatomists to suggest that there was much, much more to be uncovered on the human body, and that the current systems were preventing medical professionals from expanding and growing. Switching gears to observe the tendencies of our society today, the failure to value the expedition rather than the destination is not only portrayed with how others perceive the work of Andreas Vesalius, but also in the way we perceive others' success. As students, teachers, and members of society, we tend to become overly fixated on solely the outcome of a person's efforts. SAT scores, college acceptances, occupation, income, and more. We overlook the path the person has chosen to walk on before reaching this point, and we overlook the various ups and downs the person has faced in order to stand where they are today. We let the destination become our defining factor, and thus we cease to recognize the value in the process. What has your journey been like up until this point? How have your experiences changed your outlook on the world? What kind of person are you? These are all questions we fail to ask each other as fellow members of society. We must learn from Andreas Vesalius' legacy that often, the result is small and insignificant compared to the journey, the growth, and the process.

Works Cited

"Vesalius, Andreas." *World Book Advanced*, World Book, 2022,

www.worldbookonline.com/advanced/article?id=ar584100. Accessed 28 Apr. 2022.

"Andreas Vesalius." *Britannica School*, Encyclopædia Britannica, 14 Jan. 2021.

libraries.state.ma.us/login?eburl=https%3A%2F%2Fschool.eb.com&ebtarget=%2Flevels
%2Fhigh%2Farticle%2FAndreas-Vesalius%2F75167&ebboatid=2872723. Accessed 29
Apr. 2022.

"Andreas Vesalius." *World Eras*, edited by Norman J. Wilson, vol. 1: European Renaissance and
Reformation, 1350-1600, Gale, 2001. *Gale In Context: Biography*,
link.gale.com/apps/doc/K1646100053/BIC?u=mlin_m_brookhs&sid=bookmark-BIC&xi
d=9261d374. Accessed 17 May 2022.

Haggard, Howard W. "Andreas Vesalius." *Journal of the Washington Academy of Sciences*, vol.
34, no. 1, 1944, pp. 1–10. *JSTOR*, http://www.jstor.org/stable/24533199. Accessed 20
May 2022.

Byrne, Joseph P. "Medical Education in Europe: 16th Century." *Daily Life through History*,
ABC-CLIO, 2022, dailylife.abc-clio.com/Search/Display/1432807. Accessed 20 May
2022.

A Non-Habituating Configurable Audio Visual Animal Deterrent System to Mitigate Roadkill By Vedant Srinivas

Abstract— Growth economies continue to be more reliant on roadways than ever before. Over 30,000 miles of road are added yearly to the already enormous road system that exists in the United States. As roads segment habitats, animals have no option but to walk across them for food, water and companionship. In the process they end up becoming roadkill. Wherever wildlife habitat and roadways overlap, roadkill seems inevitable (Shilling, 2020). These animal deaths have a direct impact on the biodiversity and dynamics of an ecosystem and roadkill poses a threat to many species that are fighting extinction. Vehicles colliding with animals results in human fatalities, life changing injuries and extensive property damage. Current methods of handling roadkill are primarily passive and do not utilize the animal's natural instincts. This paper presents an alternative approach by actively involving the animal, warning them of an oncoming vehicle and triggering their survival instincts. Making the animal an integral part of the solution, augmenting their sensory perception with science and technology and utilizing their heightened reflexes and survival instincts provides a better chance at mitigating the problem of roadkill. The results show that this solution is able to provide animals a warning of an oncoming vehicle, consistently, reliably and in a wide range of testing conditions.

Introduction

Most ungulates are crepuscular animals, i.e., are most active at dawn and dusk. Owing to this behavior, their visual acuity is highly tuned for low light conditions. When they are near roads and a rapidly-moving vehicle with bright lights approaches them with little warning, they are blinded and either freeze all movement or behave irrationally. Humans have comparatively slow reflexes in relation to animals, and braking at high speeds to avoid animal encounters leads to around 200 human fatalities and tens of thousands of injuries to drivers yearly. The total cost of damage to vehicles in these collisions reaches roughly $3.6 billion annually (Gaskill, 2013).

There are a total of 4.18 million miles of road in the United States (Russell, 2020). Additionally, there were 285 million vehicles registered in the USA in 2019 (US VIO Vehicle Registration Statistics, 2021). Due to this growth of roadways with passive controls for animal protection it has reached a point where more than a million animal lives are lost on the roads of the United States every day (Roadkill Statistics, 2005).

Prevalent solutions to roadkill have relied on signage and good intentions of the driver. "For now, the combination of deer crossing signs, articles to warn the public, and defensive driving will have to do," says David C. Yancy, a deer biologist with the Kentucky Department of Fish and Wildlife Resources. By making animals an integral part of the solution, augmenting their sensory perception with science and technology, and utilizing their heightened reflexes and survival instincts, this solution stands a better chance at mitigating the problem of roadkill. Animals have always relied on sounds and road vibrations along with their sharp reflexes to avoid danger. The four noise generating components of a vehicle include; the engine, the exhaust, the aerodynamics, and the tires moving on the roads (Bernhard & Sandberg, 2005). With the rise of aerodynamically efficient electric drivetrains, low noise and vibration free roads the era of mobility is much less noisy than gasoline-powered vehicles. Distracted driving owing to a feature rich dashboard in addition to mobile device usage reduces driver attention and doubles human reaction times (Yager et al., 2012). With rapid urbanization and growth in population, cities have encroached on rural-urban interfaces, making the nation's roads deadly for wild animals.

Road mortality poses a threat to 21 endangered or threatened species including red wolves, certain species of deer, tortoises and even crocodiles in the United States alone ("Wildlife-Vehicle Collision Reduction Study: Report To Congress," 2008). Overall, roadkill has a drastic impact on the environment and poses many ecological risks, including threatening the biodiversity of ecosystems and extinction (Coffin, 2007).

Existing Solutions

Passive road signage warning of animal presence in the area is one of the most common, and at the same time most ineffective mitigation measures (Rytwinski et al., 2016). There are other solutions that have been tried and tested, but fail to show promise due to high costs and ineffectiveness.

Fencing is a roadkill reduction mechanism but requires a lot of planning, cost and installation time to get right. It is either too expensive when executed for millions of miles of highways or is just not feasible in high density areas. When installed, care must be taken to avoid creating a permanent divider that keeps animals from accessing habitat on the other side of the fence ("Wildlife-Vehicle Collision Reduction Study: Report To Congress.," 2008). If crossing opportunities are not provided, animals will try to break through the fencing and this in turn causes more financial drain through operations and maintenance work. Bridges and underpasses are possible solutions to provide this safe crossing but they are very expensive and there is no way to force the animals along these paths.

An active driver warning system warns drivers of animal presence in the area. The driver becomes aware of the animal's potential presence, but combining the time it takes for the average driver to react to the animal on the road, apply the brakes, and come to a complete stop, would mean a car traveling at 60 mph would travel over 270 feet in ideal driving conditions. Such sudden breaking also leads to loss of control and accidents for the driver, other vehicles nearby and property damage.

Proposed Solutions

The most prevalent solutions to roadkill are primarily passive. In order to make the animal an integral part of the solution, this device senses an oncoming vehicle and alerts an animal through audio and visual cues. This enables utilizing the animal's relatively quick reaction times and safety instinct to help prevent loss of lives and property.

In order to accomplish the goal of triggering the animal to get out of harm's way two things are needed. First is a device that can sense and provide the warning to the animal with enough time to act on it and the second is to deliver the trigger in the most effective way to trigger the right response. There is existing research in identifying the triggers that are most effective in invoking the animal's escape response. So, if successful in triggering accurately with enough time to act then the solution is successful.

The proposed solution is a device that utilizes ambient light sensors along with self learning algorithms to detect the luminosity along the direction of the road. If this luminosity is increasing at a rapid pace then a warning light starts to blink and the system starts playing a random trigger sound. This audio signal is to alert any animals in the near vicinity, allowing them

to get out of the oncoming automobile's path early, while the blinking lights warn the driver of an animal prone stretch of road.

Method

Components

This device is made up of several components that have been integrated into a custom designed printed circuit board. These components include, an Arduino MkrZero Board, two I2C ambient light sensor circuits, a multiplexer, a solar charge controller, a Li-Po battery, a solar panel, and an I2S circuit containing an 8 ohm speaker. The device is driven by an intelligent, self learning and calibrating algorithm that can minimize false positives, have high recall, precision and low trigger latency under a wide range of lighting conditions. The device cycles through multiple triggers to avoid habituation of the animals to any one trigger.

In order for the solution to be effective in triggering at the right time noise filtering of the sensor readings, normalization and calibration of the sensor signals and habituation need to be overcome.

Noise Filtering

Ambient Light Sensors (ALS) provide measurements of ambient light intensity which match the human eye's response to light under a variety of lighting conditions. Each sensor has a specific operating range of performance, from very low light up to bright sunlight. The ALS that was used for this research has a detection range between 188 uLux and 88000 Lux. This wide dynamic range made this ALS ideal for the operating scenario between midnight dark and oncoming headlights. The system uses the ratio of the sensor readings to the baseline light reading to identify an approaching vehicle. The raw signal generated by the ALS sensor is noisy and in its raw form generates a high false positive rate.

A simple moving average algorithm is good at removing noise in data but when run through the ALS signal it was unable to effectively filter out the false positives. In order to eliminate noise effectively an inertial moving average algorithm was developed.

$$\underbrace{IMA_i \ = \ IMA_{i-1} \ . \ \alpha \ + \ (1 \ - \ \alpha) \ . \ A_i}$$

A_i is the curent sensor value. Changing α changes the inertia.

This algorithm keeps track of a moving value of the sensor reading. With every new data point , the algorithm weighs the moving value by the inertia parameter and the complement of the weight for the latest reading. This filters out high noise levels and provides a configurable model for noise vs signal reactiveness.

Calibration and Change Detection

In order to detect when the light changes at a quick rate the algorithm maintains two Inertial moving average values. The first value has very high inertia and moves slowly - this is the baseline light level. The second inertial moving average has low inertia and follows the raw signal closely while filtering out the noise - this is called the instantaneous light level. These signal plots for a period of time are shown in Figure 1 with a simple moving average and the raw signal as comparison data points. The blue line represents the raw signal and yellow the baseline IMA.

When the ratio of the instantaneous to baseline exceeds a specific threshold the system triggers a positive detection. The Inertial Moving Average algorithm also adapts to the light level of the environment and prevents the need to globally normalize every sensor's signal range as well as calibrate to deployment site conditions.

Habituation

Habituation is a common problem faced by technology when addressing wildlife related issues. Animals start to get used to deterrents when there is no positive or negative impact afterwards. (Coulson & Bender, 2020). Evidence exists of fallow deer getting habituated to similar tonal sounds after 5 days of testing (Ujvári et al., 2004). A similar experiment run with roe deer demonstrated that natural sounds like wolf howls reduced reaction times and proved much more effective, while also remaining just as effective throughout the 5 years of the study (Babińska-Werka et al., 2015).

The device was built to take in an SD card with audio files of the sounds that could be used as triggers. This way the trigger sounds can be selectively curated and tuned for common animals in a specific zone. The device, when triggered, plays these sounds randomly to avoid habituation to any one sound.

From a visual acuity perspective, deer, one of the leading victims of roadkill, are more sensitive to certain colors. White-tailed and fallow deer had a high range of sensitivity with light

wavelengths from 450 to 542 nanometers, which represent shades of blue and green (Jacobs et al., 1994). As deer represent a large range of ungulates, which are highly susceptible to roadkill, the choice of the visual signal was kept to be configurable and defaulted to the green spectrum.

Testing & Results

The device was set up on a long stretch of a four lane state highway. The ambient lighting at the time of study was in line with night time driving conditions. The speed limit on this road was 45 - 55 mph. The vehicle type was noted for post analysis. Other variability was introduced by testing under street lights as well as completely dark conditions.

TABLE I

END TO END PERFORMANCE

Metric	Performance
Recall	96.5%
Precision	100%
False Positive Rate	0%

The device was tested on 200 random instances of oncoming vehicles. In 193 of those instances the vehicles were successfully identified and the audio visual trigger was engaged yielding a recall of 96.5% at a precision of 100% and false positive rate of 0%. The device was able to provide an average trigger of 3.7 seconds and a trigger distance of 244 ft for the animal to react and for bigger vehicles this number went up to over 500 ft and 10 seconds.

Discussion

A histogram of detections is presented in Figure 2. Any vehicle that was detected within 60 ft of the device was considered to be a failure as it would not provide enough time for the animal to react. In real world settings this trigger is still useful for animals downstream from the device location.
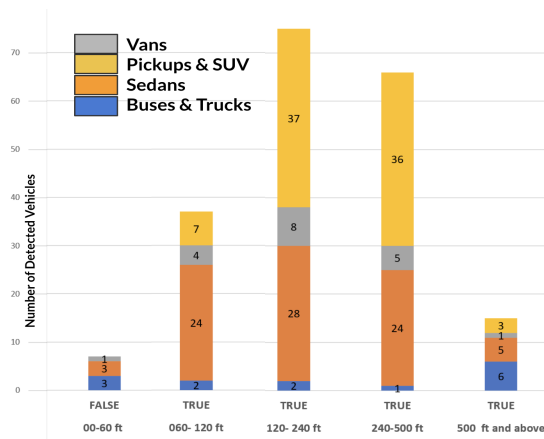
Fig. 2 Histogram of vehicle detections by type

Four of the failures were with old vehicles having yellow, incandescent headlights. 14% of the vehicles fell into this category, and the average distance triggers were 157 ft., a 39% reduction compared to the overall average. The other three false negatives were with semi trucks that were in the farthest lane from the device and were following a caravan of vehicles, which had continuously triggered the device for a long period of time. When there is continuous high intensity light for extended periods of time the system stops triggering to avoid noise and light pollution. Even though this is by design for the purpose of this research these data points were considered failures.

Since most vehicles travel with low beams, placing the at about 3-4 Ft from the ground yielded the greatest trigger distance. Buses and Trucks have a higher center for their light cone and were able to trigger over long distances even when the device was placed over 4 Ft heights. On highways with many lanes (greater than 4), or those which have tall dividers along the middle light from one side of the freeway might not reach the other side. The light cone of vehicles being narrow to avoid distraction for traffic coming from the other direction coupled with road dividers that are meant to ensure crossing traffic safety are challenges for the device. The recall and precision numbers remained unchanged for up to 4 lanes of road. In scenarios where there are more than 4 lanes, it is better to install the devices in the middle of the freeway having equal visibility to both sides.

Works Cited

Babińska-Werka, J., Krauze-Gryz, D., Wasilewski, M., & Jasińska, K. (2015). Effectiveness of an acoustic wildlife warning device using natural calls to reduce the risk of train collisions with animals. Transportation Research Part D: Transport and Environment, 6–14. https://doi.org/10.1016/j.trd.2015.04.021

Shilling, Fraser & Collinson, Wendy & Bil, Michal & Vercayie, Diemer & Heigl, Florian & Perkins, Sarah & Macdougall, S.. (2020). Designing wildlife-vehicle conflict observation systems to inform ecology and transportation studies. Biological Conservation. 251. 108797. 10.1016/j.biocon.2020.108797.

Bernhard, R., & Sandberg, U. (2005). Tire-Pavement Noise- Where does it come from? TRNews.

Coffin, A. W. (2007). From roadkill to road ecology: A review of the ecological effects of roads. Journal of Transport Geography, 5, 396–406. https://doi.org/10.1016/j.jtrangeo.2006.11.006

Coulson, G., & Bender, H. (2020). Roadkill mitigation is paved with good intentions: a critique of Fox et al. (2019). Australian Mammalogy, 1, 122. https://doi.org/10.1071/am19009

Shilling, Fraser & Waetjen, David. (2015). Wildlife-vehicle collision hotspots at US highway extents: Scale and data source effects. Nature Conservation. 11. 41-60. 10.3897/natureconservation.11.4438.

Gaskill, M. (2013, May). Rise in Roadkill Requires New Solutions - Scientific American. Scientific American; Scientific American. http://www.scientificamerican.com/article/roadkill-endangers-endangered-wildlife/

Jacobs, G. H., Deegan, J. F., Neitz, J., Murphy, B. P., Miller, K. V., & Marchinton, R. L. (1994). Electrophysiological measurements of spectral mechanisms in the retinas of two cervids: white-tailed deer (Odocoileus virginianus) and fallow deer (Dama dama). Journal of Comparative Physiology A, 5, 551–557. https://doi.org/10.1007/bf00217375

Ray, C. C. (2010, November 29). Deer in the Headlights - Science Q&A - The New York Times. The New York Times - Breaking News, US News, World News and Videos. http://www.nytimes.com/2010/11/30/science/30qna.html

Roadkill statistics. (2005). High Country News – Know the West. http://www.hcn.org/issues/291/15268

Robert, J. (2020, May 15). Frequently Asked Questions – The American Road & Transportation
       Builders Association (ARTBA). The American Road & Transportation Builders
       Association (ARTBA). https://www.artba.org/about/faq/

Rytwinski, T., Soanes, K., Jaeger, J. A. G., Fahrig, L., Findlay, C. S., Houlahan, J., van der Ree, R.,
       & van der Grift, E. A. (2016). How Effective Is Road Mitigation at Reducing Road-Kill? A
       Meta-Analysis. PLOS ONE, 11, e0166941. https://doi.org/10.1371/journal.pone.0166941

Ujvári, M., Baagøe, H. J., & Madsen, A. B. (2004). Effectiveness of acoustic road markings in
       reducing deer-vehicle collisions: a behavioural study. Wildlife Biology, 1, 155–159.
       https://doi.org/10.2981/wlb.2004.011

US VIO Vehicle Registration Statistics. (2021, January 19). Hedges & Company;
       https://www.facebook.com/HedgesandCompany/.
       http://hedgescompany.com/automotive-market-research-statistics/auto-mailing-lists-and-ma
       rketing/

"Wildlife-Vehicle Collision Reduction Study: Report To Congress." (2008). Federal Highway
       Administration. http://www.fhwa.dot.gov/publications/research/safety/08034/exec.cfm

Yager, C. E., Cooper, J. M., & Chrysler, S. T. (2012). The Effects of Reading and Writing
       Text-Based Messages While Driving. Proceedings of the Human Factors and Ergonomics
       Society Annual Meeting, 1, 2196–2200. https://doi.org/10.1177/107118131256146

Algae Biofuels - An Eco Friendly Alternative to Petroleum Jet Fuel By Kushaan Naskar

Abstract

Travel by air has been significantly increasing year to year and will double in the next 15 years. The International Air Transport Association (IATA) is already looking at ways to reduce carbon emissions and bring this down to zero by 2050. Sustainable Aviation Fuel (SAF) is made up of fuel feedstocks such as agricultural crops or microorganisms like algae. Algae biofuels can perform as well as petroleum-based jet fuel but with a much lower carbon footprint. It can reduce the emission of Greenhouse Gasses significantly compared to traditional jet fuel. Studies have shown that biofuels can reduce pollution significantly as well as reduce the existence of methane gas from the atmosphere. Although SAFs provide many benefits, they only make up 1% of the aviation fuel used today. This is due to the low supply of SAFs which results in a higher cost compared to petroleum fuel. Investments are being made through technology or artificial intelligence mechanisms towards the mass production of algae biofuels and when the supply of SAFs meets the demand of the airplane industry, it will become more affordable and widely used. This paper will present the advantages of alternative aviation fuel made up of algae biofuel, the benefits of Sustainable Aviation Fuel when produced at scale and techniques on how to increase mass production of algae fuel.

Introduction

Travel by air has been increasing every year and with this increase, there is a significant increase in carbon emissions. Many of the other industries have already taken a sustainable approach by finding alternatives to reduce the carbon footprint and lower travel pollution. However, the aviation industry is severely lagging and is now looking into the mass production of Sustainable Aviation Fuel (SAF). Research indicates that SAFs can reduce carbon emissions significantly in comparison to traditional petroleum fuel. Gasses that trap heat in the atmosphere are called greenhouse gasses. Carbon dioxide is a major contributor of greenhouse gas emissions. They enter the atmosphere when fossil fuels are used which results in chemical reactions that impact the climate negatively. Emission of greenhouse gasses in large quantities results in higher concentration in the atmosphere that can last for several years.

Carbon dioxide is a chemical compound constituted by two elements - carbon and oxygen. This chemical compound is a leading cause of greenhouse gas and contributes to climate change through the burning of fossil fuels. The aviation industry is a major contributor to global warming. Aircrafts are powered by liquid fuel made mostly from fossil fuels. Although there are other alternatives to fossil fuels, like sustainable aviation fuel (SAF), which reduce carbon emissions significantly by 60%, it is still not widely used due to the cost associated with SAF. The cost of SAF is usually two to four times more than conventional aviation fuel. Aviation fuel accounts for 30-60% of the operational cost (Pande). The significant cost of SAF is one of the main reasons that the airline industry has still not adopted a more climate friendly alternative to fossil fuel.

There is a major initiative by the government to reduce carbon emissions and to target net-zero carbon emission by 2050 ("Aviation Climate Action Plan"). SAFs are more climate friendly and are made from renewable resources. SAF is also quite similar to fossil fuel and can be a cleaner alternative to fossil fuel. It has already been used by 250,000 flights. However, the supply of the renewable resources needed by SAF is limited and given the constant rise in demand of the travel industry, the price of SAF is significantly high as supply has not been able to meet the demand expectations. Currently SAF production is limited to only tens of millions of liters a year but the production of SAF needs to rise to billions of liters a year. Although there are enough raw materials to produce SAF, governments and industries need to invest more to mass produce SAF. These investments can be using enhanced technology or newer mechanisms such as artificial intelligence which would promote and regulate conditions that would lead to the mass production of algae. SAFs would become more affordable if the demands of the airplane industry are met through the result of this mass production.

Projected Fuel Consumption (In Billion Liters)
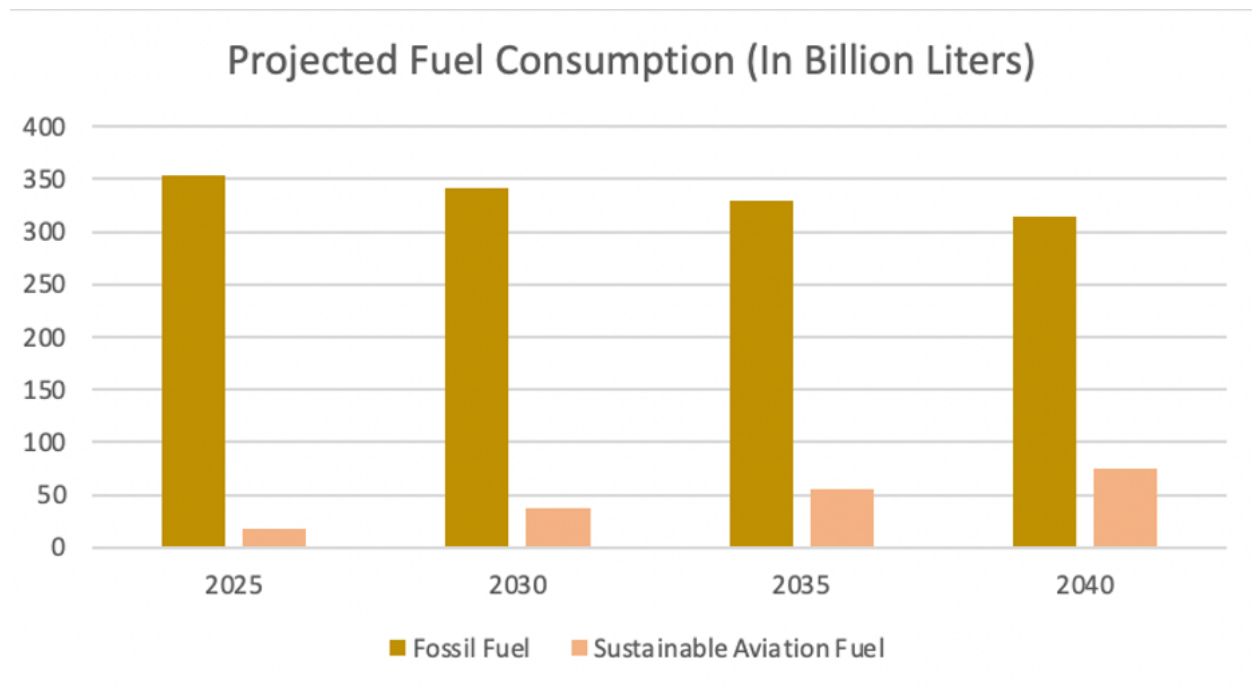
Figure 1: Comparison of projected fuel consumption for Fossil Fuel versus Sustainable Aviation Fuel ("Are aviation biofuels ready for take off? – Analysis")

Pollution caused by petroleum fuels versus algae biofuels

Petroleum fuels are formed from the remains of plants and animals from millions of years ago. Due to heat and pressure from layers of sand, rock, silt and salt, their remains turn into what we call petroleum fuel today.

The increase in pollution caused due to petroleum fuel has led the airlines industry to look for alternative sustainable approaches. The substances that are emitted from the burning of traditional fuel are detrimental to the environment. Substances like carbon dioxide, carbon monoxide and nitrogen oxides are normally emitted. Studies show that burning fossil fuels produces about 21.3 billion tons of carbon dioxide annually ("The fossil-fuels and the global warming"). These large amounts of emissions are leading causes of global warming.

Algae biofuels, on the other hand, leave a significantly lower footprint on the ecosystem and may eliminate up to 60 percent of the carbon dioxide emissions in comparison to petroleum fuels.

About half of the carbon dioxide emissions from energy use were due to petroleum fuels in 2021. 3 percent of the nation's greenhouse gasses are produced from petroleum fuels. ("Where greenhouse gases come from - U.S. Energy Information Administration").

Burning 1 gallon of algae fuel emits over 2000 grams of carbon dioxide (Smoot, "What Is the Carbon Footprint of Algae Fuel? A Life-Cycle Assessment.") whereas fossil fuels emit over 16000 grams of carbon dioxide for the same amount of fuel. Algae fuel has a low carbon footprint across all the lifecycle stages like building of an algae farm, extraction, and transportation of algae fuel. Similarly, the life cycle of petroleum fuels includes building of petroleum refineries, extraction, and transportation of petroleum fuel. Carbon emission in all these different life cycle stages of petroleum fuel is high. The manufacturing of machinery needed for petroleum refineries like boilers and compressor engines have a high carbon footprint. Even the construction of the buildings emits large amounts of carbon dioxide. Likewise in every step of the extraction process from the rig site preparation, to drilling to fracking, there is a heavy carbon footprint. (Smoot, "What Is the Carbon Footprint of Aviation/Jet Fuel? A Life-Cycle Assessment.")

Petroleum fuel is transported through a variety of ways including pipelines, trucks, railroads, etc. Transportation vehicles may be classed as Very Large Crude Carriers or Ultra Large Crude Carriers depending on its size. Transportation of petroleum fuel occurs from extraction wells to the petroleum refineries via tankers, trucks, and railroads. Upon completion of petroleum refinement, fuel is then transported to the aircrafts again via tankers, trucks, and railroads. ("Research Guides: Oil and Gas Industry: A Research Guide: Modes of Transportation")

Carbon emission during the transportation phase depends mainly on the distance of where the fuel is produced versus where it is being consumed. If the production and consumption is within the same country, say for instance within the United States, the carbon footprint is lower versus if the production is in the United States and the consumption is in Germany. In this case, there will be many different modes of transportation thus contributing to a high carbon footprint. (Smoot, "What Is the Carbon Footprint of Aviation/Jet Fuel? A Life-Cycle Assessment.")

Currently there aren't many countries involved in the production of biofuels and hence a global market has not been established. Some of the larger countries that produce biofuels include the United States, Germany, Brazil, and a few in Asia. Like the transportation of petroleum fuel, if the distance between the country of production to the country of consumption is large, the carbon footprint will be large due to the carbon dioxide emission during the various modes of transportation. On the other hand, if both the production and consumption is done in

the United States, the carbon footprint can be minimized. (Smoot, "What Is the Carbon Footprint of Aviation/Jet Fuel? A Life-Cycle Assessment.")

Pollution Reduction in the Aviation Industry

Transportation Emission
(lbs of Carbon dioxide per passenger per mile)
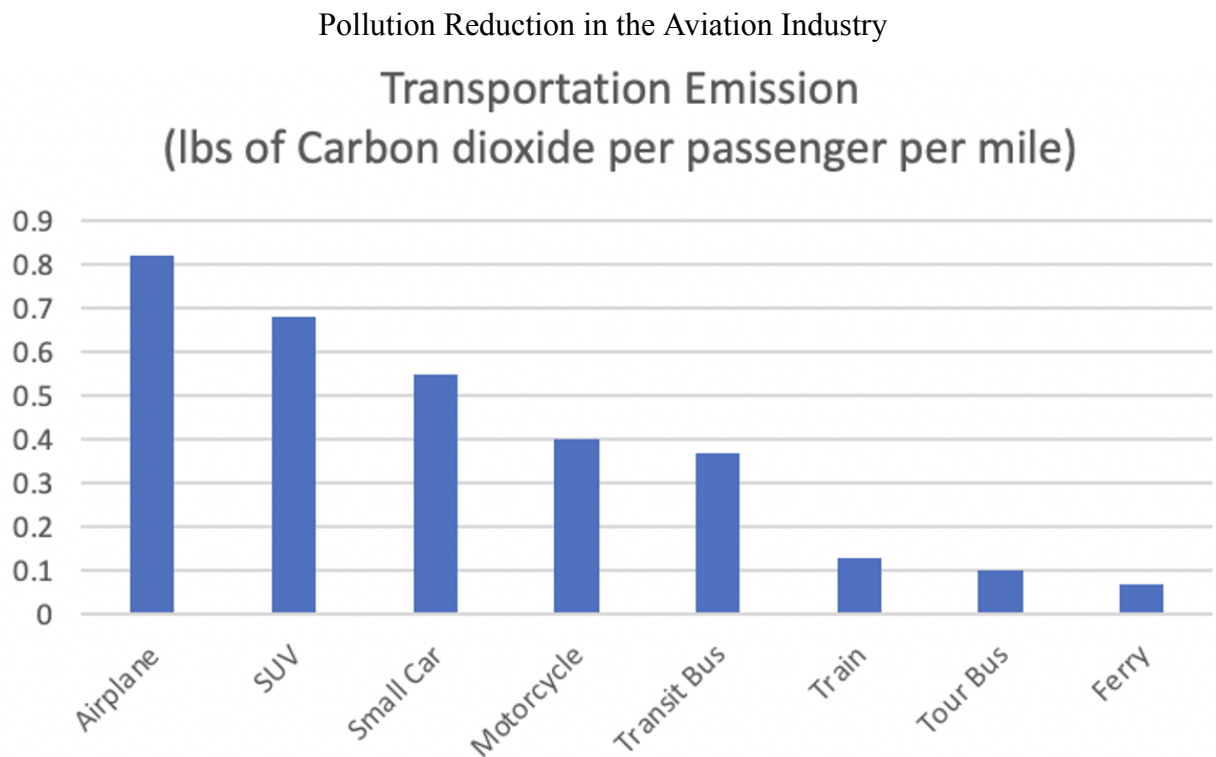
Figure 2: Carbon dioxide emissions by mode of transportation ("Carbon Footprint of Tourism")

Aviation is one of the fastest growing industries in the transportation sector and is one of the largest contributors of greenhouse gas emissions (Figure 2). The aviation sector is now investigating sustainable approaches to a cleaner environment for the future. The Civil Aviation Organization is encouraging the airline industry to fly more efficient aircrafts that use sustainable aviation fuels and promote the reduction of carbon emissions. 81 nations have been encouraged to participate in this program and the hope is this will begin the journey to a more climate friendly future. The Environmental Defense Fund (EDF) has mandated strong aviation carbon dioxide standards as the pollution contributed from aviation poses great danger to the environment ("Reducing aviation's impact on the climate"). Contrails are large white stripes that come out of jets and contain soot particles that are emitted during air travel (Kimbrough). Usage of SAF will reduce the number of pollutants released during flight travel and thus meet clean

climate goals. However, the decarbonization effort is long and extremely challenging due to many factors like price and availability of SAF. A focus on the uptake of SAF adoption is essential towards the successful decarbonization journey. White House's measures to increase SAF adoption through the mass production of biofuels is a great initiative that could alleviate the demand challenges of SAF (Hoag).

Sustainable Aviation Fuel (SAF) is found to be an excellent candidate for reducing pollution in the atmosphere. Cleaner fuels reduce the carbon dioxide, and non-carbon dioxide emissions thus reducing the reliance on fossil fuels and hence resulting in immediate positive impact to the climate. Studies show that SAF reduces emissions by 80% (Weiss). To reduce pollution, SAF is now used in conjunction along with traditional kerosene fuel. This mixed combination of traditional and biofuel has been used in many commercial flights after the commercial certification for SAF was approved in 2011. More than 250,000 flights have been powered by this mixed combination of fuel. The mixture can be 10%-50% of SAF mixed with the rest being traditional fossil fuel. The goal is to eventually move towards a full-scale replacement of 100% SAF usage for aviation fuel as algae biofuels contribute to a better environment by removing carbon dioxide from the atmosphere and turning it into biomass and oxygen. This is done through photosynthesis that is required to produce algae biofuel and can be beneficial if integrated into our day to day lives. Algae cultivation is still in an infancy stage, but aggressive plans are required to be put in place to achieve an eco-friendly jet fuel world. The main factors holding us back from meeting the sustainable goals of the aviation industry are economic and technological challenges which we will dive into next. ("Clean Skies for Tomorrow: Sustainable aviation fuels as a pathway to net-zero aviation")
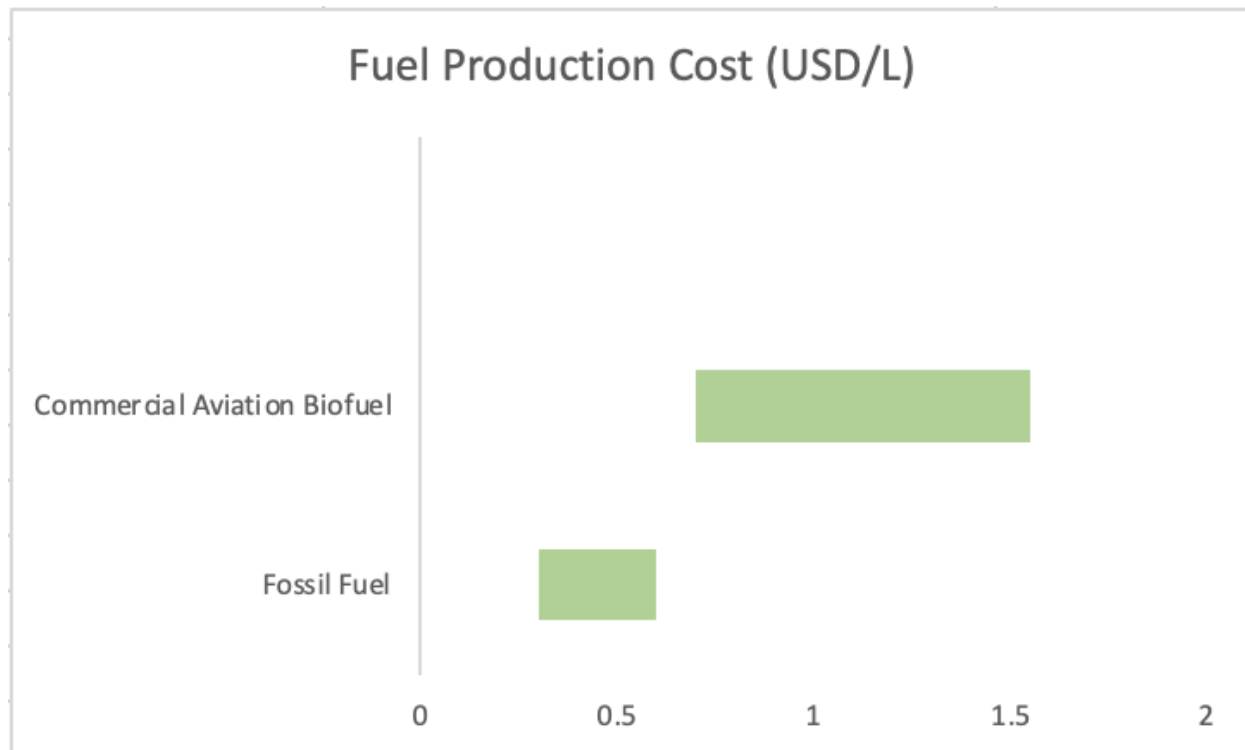
Figure 3: Comparison of fuel production cost ranges for Fossil Fuel versus Commercial Aviation Biofuel ("Are aviation biofuels ready for take off? – Analysis")

Algae are tiny organisms that grow quickly and reduce the presence of carbon dioxide in the atmosphere. It is a great renewable resource for sustainable fuel. There are currently many studies that are in progress to find out efficient and cost-effective mechanisms of algae production. One economically feasible mechanism is to mass produce algae by increasing the lipid yields in microalgae without impacting the growth or biomass. Lipids are organic compounds that include natural oils. Through metabolic engineering, transgenic strains are developed which help increase lipid accumulation and yield. Transgenic strains are when organisms undergo some form of genome transformation. Studies indicate that this process of biofuel production is economical and can be easily adopted and used widely. Although a viable solution in terms of mass production, there is a lot of improvement required in terms of enhancing the efficiency to increase production and reduce cost (Roychoudhury).

Aquafarming is yet another method by which the production of biofuel can be quite cost effective. This process involves raising fish for food and using fish waste for biofuels. This has proven to be quite efficient. This method involves extracting oils from fish waste and is mixed with methanol and other products to produce biofuel. For instance, 1kg of fish gut can lead to 12

liters of biofuel. Microalgae are less than 30 microns in size and hence are great in utilizing this for large scale aquatic farming. The nutrients from the fish farm wastewater is a great source of microalgae cultivation. (Piccolo)

Due to the pandemic, the demand for jet fuels decreased resulting in the prices increasing. Jet fuel is made by blending and refining various crude oil petroleum distillation products such as naphtha, gasoline, or kerosene ("Production, Import/Export, Use and Disposal"). Jet fuel price is based on crude oil prices. If crude oil prices drop, that could positively impact the cost of jet fuels. However, with the increase in travel, the need for larger aircrafts is essential, hence impacting the cost of jet fuels. The recent situation in Ukraine has also exacerbated the price of jet fuels ("IATA Factsheet - The impact of the war in Ukraine on the aviation industry") and many airplane industries are now looking to move to more cost-effective fuel alternatives.

The airline industry has had many government subsidies over the years which has promoted the avoidance of more climate friendly alternative approaches for jet fuels. Aviation subsidies are defined as cost benefits that are provided to aviation consumers and producers. In fact, there are current tax benefits like zero-tax policy or minimal tax burden on international flights. In countries like the UK where the per passenger tax is quite high, there are aviation tax exemptions provided that sum up to over $10 billion annually ("Why It Is Time to End Aviation Subsidies").

Unfortunately, even in these times with such a negative impact to the climate, there are proposals to increase the 40 million flights a year and this is possible due to the aviation subsidies. These aviation subsidies encourage aviation sectors to have a continuous growth in airplanes flown per year. Data leads to an increase in air traffic every 15 years and indicates that air traffic has doubled between 2015-2019 causing a 33% increase in carbon emissions. ("Why It Is Time to End Aviation Subsidies")

However, there are new subsidies that have been created for renewable jet fuels and a plan put in place for extending the current tax credits for sustainable fuel to 2031. The biofuel subsidies are part of the clean energy incentive. To qualify for this subsidy, the sustainable fuel must prove 50% less carbon emission when compared to traditional jet fuel. Biden's FY22 budget plan includes a tax credit proposal for a new sustainable fuel tax credit. The current tax credit for sustainable fuel costs taxpayers $3 billion annually. ("Rolling Analysis, President's FY22 Budget - $7 Billion for Sky High Aviation Fuel Subsidies")

Algae is expensive, requiring a lot of water and energy. The cost is high due to a large amount of energy that is required to circulate gasses inside the photo bioreactors which are used to produce algae. It takes a lot of energy as well to dry out the biomass. Algae can lead to yielding 5000-10000 gallons per acre (Wesoff) and hence we should look for ways on how to mass produce this in a more cost-effective manner.

Producing algae is also labor intensive. Although it is currently estimated to be around 300 to 900 euros per kilogram of algae, Sander Hazewinkel, chief commercial officer of Dutch firm LGem claims that it may be reduced to 100 euros depending on the operation's size (Waycott). Algae biofuel currently costs about $32.81 a gallon (Kanellos).

In comparison, the price of Jet A1 fuel was estimated to be around $816 per metric tonne in January 2022. This converts to around $2.46 per gallon of jet fuel ("How Much Does Jet Fuel Cost? | The Price Of Jet A1"). Due to algal biofuels costing more than thirteen times what jet fuels cost, the production of algal biofuels is negatively impacted; however, due to Ukraine's conflict with Russia, the price of jet fuels has increased significantly. Because of this sudden rise in jet fuels' prices, the search for an alternative source of fuel is necessary.

Mass Production of Algae Biofuels through Technology and Artificial Intelligence Petroleum fuel is still the more preferred approach for airlines since the cost of producing algae fuels is high. Nevertheless, the increased need to move to a more sustainable future calls for new investments to increase algae biofuel production. If companies are successfully able to mass produce biofuels, this will drive the reduction in cost of algae biofuels. Hence, the continued investment in biofuel production is essential. Bioenergy Technologies Office (BETO) supports the research and development of sustainable use of biomass resources for mass production of biofuels. Algenol, a biotechnology company, has an algae strain that helps in the production of ethanol directly and has a mechanism to convert biomass into hydrogen fuels which are used for jet fuels. Algenol has proven to exceed its productivity of ethanol and hydrocarbon fuels to around 9000 gallons collectively per acre per year. ("Making Algal Biofuel Production More Efficient, Less Expensive")

Current research studies focus on increasing the accumulation of lipids and other energy storage compounds in different photosynthetic organisms through genetic engineering. This mechanism promotes the reduction in pollution by genetically modifying algae which makes the

usage of algae for biofuel an even more attractive alternative to petroleum fuel. Although this approach is still in its infancy stages, innovations are being done to develop advanced tooling around genetic manipulation of algae. Research is still underway to improve microalgae as a biofuel platform; however, there are still many barriers that need to be overcome before biofuels can be adopted more widely. These barriers include both technical and cost-efficient mechanisms to harvest microalgal cells to consistently mass produce algae biomass. Additionally, a deep understanding of the current makeup of jet fuel strains is important to link how lipid metabolism in algae should be configured. Studies are also focused on looking for ways to conserve and accumulate energy-rich storage compounds which helps in extending the production life of algae. ("Genetic Engineering of Algae for Enhanced Biofuel Production")

Many biofuel companies are additionally investing in engineering techniques to mass produce algae. Companies are currently investigating a mechanism called closed systems which allows the growth of algae by regulating the various conditions within the bioreactors. Algae growth has been severely impacted due to a lack of sunlight penetration and bioreactors help alleviate this dependency by allowing for the adjustment of light and temperature to promote the successful mass production of algae. Additional research is also being done by Texas A&M research scientist Joshua Yuan to use artificial intelligence which can reliably predict the light needed to promote growth of algae. Yuan's patented prediction model will allow for the synthetic production of algae at scale. Algae production is largely hindered due to harvesting costs; however, Yuan's research overcomes this challenge through machine learning techniques to regulate and sustain cell growth in algae (Fannin). Yet another approach called Mixed Integer Linear Programming (MILP) is used as a decision-making mechanism to determine tasks that can be scheduled to regulate controls in the equipment ("Supply Chain MILP Model Integrating Biorefining Technology Superstructure"). These research developments lead us to believe that algae can be mass produced and can soon be used more widely as an alternative source of renewable energy.

Conclusion

Algae biofuels provide a great alternative to traditional fossil fuel, however there are many challenges that still need to be overcome in terms of mass production of algae as well as the cost of producing algae. Technological enhancements need to be made to overcome the mass

production challenge which will also lead to cost reduction. The benefits that algae biofuels provide long term to the environment makes the investment in research and development very attractive. With increased travel needs, unfortunately fossil fuels will become more and more detrimental to the environment and moving to sustainable aviation fuel will pose more of a need to maintain a green community. Although studies on algae biofuels are still in its early stages, it is essential that we continue to strategize on solutions that will reduce the dependency on fossil fuel gradually. There are new research approaches being done that seem promising and may lead to favorable outcomes towards the increased production of algae for renewable biofuels. To be able to eventually move towards a low cost and low carbon alternative which is the response to sustainable energy in the future, investment in different innovative mechanisms through biotechnology, genetic engineering and artificial intelligence should be continued to generate best results in algae cultivation. These new techniques could significantly reduce carbon dioxide in the atmosphere and hence play an instrumental role in the quest towards a safe and carbon-free future.

Works Cited

"Reducing Aviation's Climate Impact." *Environmental Defense Fund*, 22 Aug. 2022,

https://www.edf.org/climate/aviation.

"Carbon Footprint of Tourism." *Sustainable Travel International*, 24 Aug. 2022,

https://sustainabletravel.org/issues/carbon-footprint-tourism/.

"Aviation Climate Action Plan." *Federal Aviation Administration*,

https://www.faa.gov/sustainability/aviation-climate-action-plan.

"How Much Does Jet Fuel Cost?: The Price of Jet A1." *FlightDeckFriend.com | Pilot Jobs |*

Flight Training | Aspiring Pilots, 25 Oct. 2022,

https://www.flightdeckfriend.com/ask-a-pilot/how-much-does-jet-fuel-cost/.

Radakovits, Randor, et al. "Genetic Engineering of Algae for Enhanced Biofuel Production."

Eukaryotic Cell, U.S. National Library of Medicine, Apr. 2010,

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2863401/.

Fannin, Blair. "Artificial Intelligence Predicts Algae Potential as Biofuel." *AgriLife Today*, 4

Mar. 2022, https://agrilifetoday.tamu.edu/2022/03/04/algae-as-economical-biofuel/.

4. Production, Import/Export, Use, and Disposal 4.1 Production.

https://www.atsdr.cdc.gov/ToxProfiles/tp76-c4.pdf.

Waycott, Bonnie, et al. "Making Algae Can Get Expensive. Innovations Aim to Bring Costs

down. - Responsible Seafood Advocate." *Global Seafood Alliance*, 2 Mar. 2020,

https://www.globalseafood.org/advocate/making-algae-can-get-expensive-innovations-ai

m-to-bring-costs-down/.

"Making Algal Biofuel Production More Efficient, Less Expensive." *Energy.gov*,

https://www.energy.gov/eere/articles/making-algal-biofuel-production-more-efficient-less

-expensive.

Tcs. "$7 Billion for Sky High Aviation Fuel Subsidies ." *Taxpayers for Common Sense*, 20 Sept.

2021, https://www.taxpayer.net/agriculture/sky-high-aviation-fuel-subsidies/.

Klarwein, Salvador. "Why It Is Time to End Aviation Subsidies." *Earth.Org*, 2 Dec. 2022,

https://earth.org/aviation-subsidies/.

"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *Oil and*

Petroleum Products Explained - U.S. Energy Information Administration (EIA),

https://www.eia.gov/energyexplained/oil-and-petroleum-products/.

Smoot, Grace. "What Is the Carbon Footprint of Aviation/Jet Fuel? A Life-Cycle Assessment."
Impactful Ninja,
https://impactful.ninja/the-carbon-footprint-of-aviation-jet-fuel/#:~:text=On%20a%20life
%2Dcycle%20basis,has%20various%20negative%20environmental%20effects.

Smoot, Grace. "What Is the Carbon Footprint of Algae Fuel? A Life-Cycle Assessment ."
Impactful Ninja, https://impactful.ninja/the-carbon-footprint-of-algae-fuel/.

Iea. "Are Aviation Biofuels Ready for Take off? – Analysis." *IEA*, 1 Oct. 2018,
https://www.iea.org/commentaries/are-aviation-biofuels-ready-for-take-off.

Weiss, Sabrina. "Making fuel out of algae could clean up dirty planes." *Wired UK*, 13 May 2019,
https://www.wired.co.uk/article/aviation-biofuels-carbon-emissions-waste-algae

Kimbrough, Liz. "How much does air travel warm the planet? New study gives a figure."
Mongabay, 6 April 2022,
https://news.mongabay.com/2022/04/how-much-does-air-travel-warm-the-planet-new-stu
dy-gives-a-figure/

Wesoff, Eric. "8571428 Gallons of Algae Oil Per Acre!" *Greentech Media*, 9 November 2009,
https://www.greentechmedia.com/articles/read/8571428-gallons-of-algae-oil-per-acre

Kanellos, Michael. "Algae Biodiesel: It's $33 a Gallon." *Greentech Media*, 3 February 2009,
https://www.greentechmedia.com/articles/read/algae-biodiesel-its-33-a-gallon-5652.

"IATA Factsheet - The impact of the war in Ukraine on the aviation industry." *IATA*, 25 March
2022,
https://www.iata.org/en/iata-repository/publications/economic-reports/the-impact-of-the-c
onflict-between-russia-and-ukraine-on-aviation/.

Piccolo, Tony. "Aquatic Biofuels as an Alternative." *The Fish Site*, 1 September 2008,
https://thefishsite.com/articles/aquatic-biofuels-as-an-alternative.

Hoag, Foley. "White House Push for Increase in Sustainable Aviation Fuel." *JD Supra*, 27
January 2022,
https://www.jdsupra.com/legalnews/white-house-push-for-increase-in-6228074/.

Pande, Pranjal. "How Rising Jet Fuel Prices Will Hurt Airlines and Travelers." *Simple Flying*, 24
April 2022, https://simpleflying.com/jet-fuel-prices-impact/.

"The fossil-fuels and the global warming." *OSTI.gov*,

       https://www.osti.gov/etdeweb/servlets/purl/21403712

Aditya Banerjee and Roychoudhury, Aryadeep. "Metabolic Engineering of Lipids in Plants."

       Open Science Publications,

       https://www.opensciencepublications.com/fulltextarticles/JPSR-2349-2805-1-112.html.

"Clean Skies for Tomorrow: Sustainable aviation fuels as a pathway to net-zero aviation."

       McKinsey,

       https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20

       logistics/our%20insights/scaling%20sustainable%20aviation%20fuel%20today%20for%

       20clean%20skies%20tomorrow/clean-skies-for-tomorrow.pdf.

"Why It Is Time to End Aviation Subsidies." *Earth.Org*, 28 November 2022,

       https://earth.org/aviation-subsidies/

Introduction To Tropical Geometry By May-Jann Wong

Abstract

Tropical geometry uses min-plus algebra to study polynomials. We will first discuss what tropical geometry is and why it is useful. After a brief discussion of polyhedra and polytopes, we will explore tropical operations and polynomials. Finally, we will learn how to graph tropical polynomials and hyperspaces.

1. Introduction

This is an expository paper on tropical geometry. In this paper, we will explore tropical operations and graphs as well as associated topics such as triangulations and polytopes. Note that due to the expository nature of this paper, complex topics and ideas will be explained in a simplified manner so that a reader with little to no prior knowledge of tropical geometry or associated subjects can understand.

Tropical geometry has become a topic of discussion within the mathematics community due to its potential to solve complex algebraic geometry problems through the use of tropical graphs of functions.

Named "tropical" in honor of the pioneering efforts of Brazilian mathematician Imre Simon, who worked in the tropics, tropical geometry is an area of mathematics concerned with minimums of polynomials. To understand tropical geometry, it is first important to conceptually understand its closely related field algebraic geometry. [Rau17]
For a brief introduction, algebraic geometry studies shapes formed by the solution sets to polynomial equations. Given that a field contains the coefficients of the polynomial equation, one can graph the solutions in any field. For example, one can show solutions to an equation over R^2, where R is the set of real numbers. One can also show solutions in the C^2 field, where C is the set of complex numbers. In algebraic geometry, both shapes formed by the solution set can be treated as the same by algebraic methods regardless of their visual similarities or differences. Mathematicians are interested in tropical geometry because the characteristics of tropical shapes make them easier to study compared to the algebraic shapes of the corresponding equations; thus, mathematicians use tropical geometry to study complex problems in algebraic geometry.

2. Polyhedra and Polytopes

Figure 1. Examples of polytopes in two and three dimensions.

Tropical geometrists primarily study polyhedra and polytopes.

Polyhedra and Polytopes

Definition 2.1. A polyhedron (plural, polyhedra) is the shape formed by intersect ing halfspaces in $\mathbb{R}^n$.

Definition 2.2. A polytope is a bounded polyhedron, meaning that there are no edges, faces, or other features extending infinitely.

All polytopes are polyhedrons, while not all polyhedrons are polytopes. Examples of polytopes include platonic solids in 3D space, such as cubes, tetrahedrons, and octahedrons. Polygons are polytopes in two dimensions. [Zie07]

Mathematicians are concerned with polytopes and polyhedra because they can be used to geometrically represent combinatorial problems. The structural characteristics of polytopes makes studying these problems easier. In tropical geometry, mathematicians examine the minimums of polytopes and polyhedra when studying hyperspaces, for example, which we will explore further in the section on Graphing Tropical Shapes.

3. Tropical operations, shapes, and zeroes

Tropical geometry has its own unique definitions of addition and multiplication, called tropical addition and tropical multiplication respectively.

Tropical Operations

Definition 3.1. Tropical addition is the operation of taking the minimum of a set of items.

Definition 3.2. Tropical multiplication is the operation of adding a set of items. Tropical multiplication functions the same as classical addition.

$$x \oplus y = \min(x, y) \quad x \odot y = x + y$$

While some sources define tropical addition as the maximum of two function, we will be using the definition of tropical addition given above. Note that exponentiation functions as repeated tropical multiplication (eg. a^2 in tropical geometry is equivalent to $a \odot a$. In classical arithmetic, this is equivalent to $2a$). Familiar rules such as the distributive and commutative properties apply to tropical ge ometry. [SS04]

$$x \oplus y = y \oplus x, \quad x \odot y = y \odot x$$
$$x \odot (y \oplus z) = x \odot y \oplus x \odot z$$

Tropical monomials are linear functions with integer coefficients. Thus, tropical polynomials are linear combinations of tropical monomials.

$$_n \oplus b \odot x^{j1}{}_1 \, x^{j}2$$

In classical arithmetic, a tropical polynomial would take the minimum of a finite set of linear (degree one) functions.

Exercise 3.1: Write the tropical polynomial as an expression in classical arithmetic.

$$2 \odot x^3 \oplus x^2 \oplus 5 \odot x^5 \oplus 3 \odot x$$

Recall that tropical multiplication is classical addition, and tropical addition takes the minimum. Therefore, we can rewrite the above polynomials as $\min(2 + 3x, 2x, 5 + 5x, 3 + x)$.

Now let us examine tropical roots, which are also called zeroes.

Hyperspaces and Roots

Definition 3.3. A hyperspace is defined as the set of all points of a tropical polynomial at which the minimum is achieved at least twice.

Definition 3.4. Points on the hyperspace are called roots.

4. Graphing Tropical Shapes

4.1. Tropical polynomials. Let us use an example problem to learn how to graph tropical polynomials.

Exercise 4.1: Graph the polynomial $p(x) = x \odot 1 \oplus x^2 \odot -4 \oplus x^4 \odot -7$ and find its roots.

First, recognize that this polynomial is equivalent to the expression min(x+1, 2x−4, 4x−7). The graphs of y = x + 1, y = 2x − 4, and y = 4x − 7 can be seen in Figure 2.
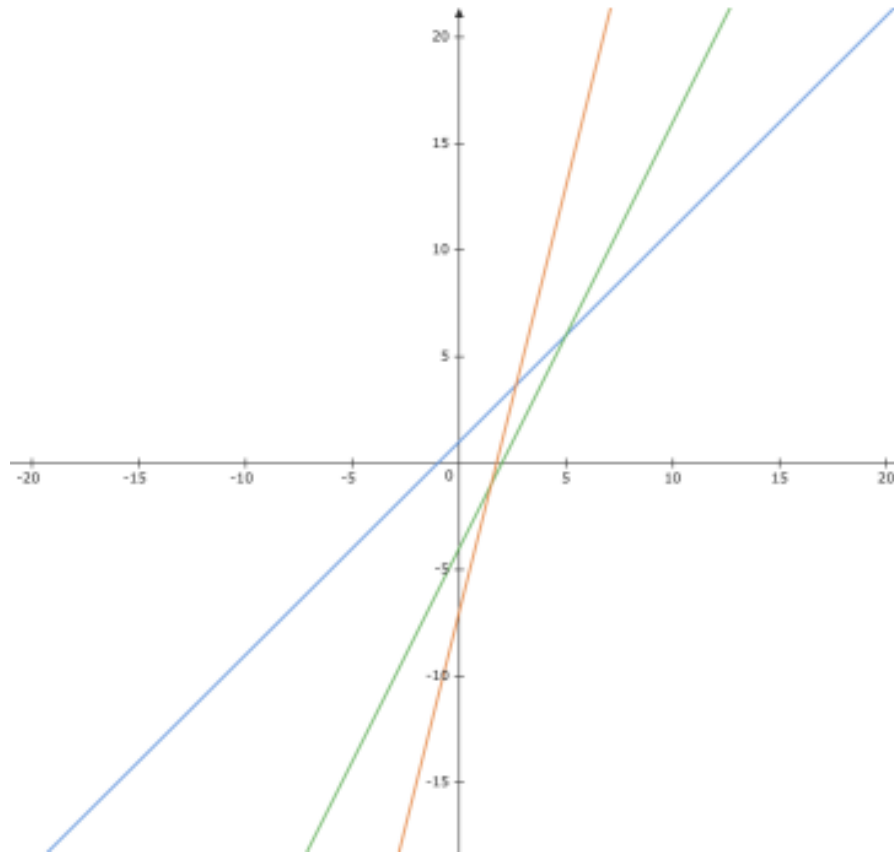
Figure 2. Graph of y = x + 1, y = 2x − 4, y = 4x − 7 in the xy plane.

To graph p(x), we must find the minimum of the set of functions at each point. Thus, the graph of p(x) can be seen in black in Figure 3. Using algebra, we can find that at (3/2, −1) and (5, 6), p(x) is nonlinear. These points are our tropical roots of p(x). At (3/2, −1), the minimum is achieved by both y = 4x − 7 and 2x − 4. Similarly, at (5, 6), the minimum is achieved by y = 2x − 4 and y = x + 1. It is at these points that the minimum is achieved at least twice.
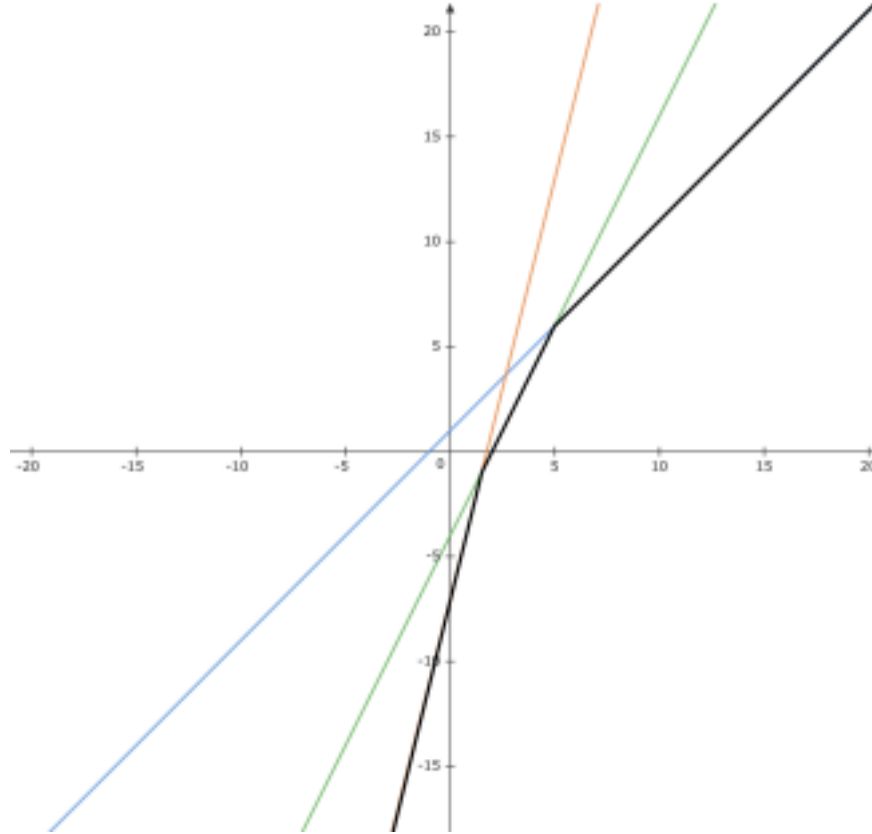
Figure 3. Graph of $p(x) = x \odot 1 \oplus x^2 \odot -4 \oplus x^4 \odot -7$ in the xy plane (highlighted in black).

4.2. Hyperspaces.

If you can recall, a hyperspace H(p) is defined as the set of all points of a tropical polynomial at which the minimum is achieved at least twice. The hyperspace is also the set of roots of a tropical polynomial.

A graph of a hyperspace H(p) can generally be graphed by projecting the convex hull (formed by taking each term of the tropical polynomial and graphing it in R^3) onto R^2. Let us break this definition into digestible parts. First, we graph each term of the tropical polynomial in R^3, which is 3D space. These terms, which form planes when graphed, intersect at various points and lines. We identify the line segments and rays at which the minimum is achieved by at least two terms of the polynomial.

Next, a simplified definition of a convex hull is the shell or outside surface of an object in space. For example, the convex hull of a solid sphere would be a hollow sphere. Thus, taking the convex hull of a tropical polynomial involves identifying the outside surface-including both bounded and unbounded edges-of the polynomial.

Once we have the convex hull, we need to project its lower envelope onto R^2, or the 2D plane. This means that we are concerned only with the lowermost surface of the convex hull,
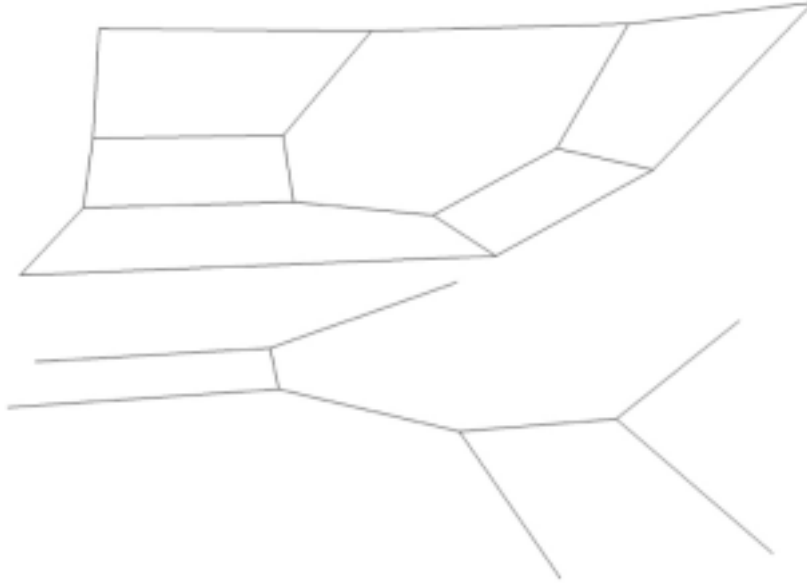
Figure 4. Example of a graph of a hyperspace. Illustrated is a convex hull in R^3 and its projection onto R^2. [MR18] effectively taking the minimum of the hull. To do this, imagine shining a light directly above the hull and seeing the resultant shadow on the 2D-plane. Edges of the hull would become line segments or rays.

Definition 4.1. Tropical curves, which are graphs of hyperspaces, follow the zero-tension condition, which states that at each node of the curve, the sum of all vectors in the west, northeast, and south directions is zero.

To illustrate our understanding of graphing hyperspaces, let us use an example. Exercise 4.2:
Graph the hyperspace of the tropical polynomial
$$4 \odot x \oplus 5 \odot y \oplus 3.$$
First, we graph each of the terms of the polynomial in R^3, as shown in Figure 5.
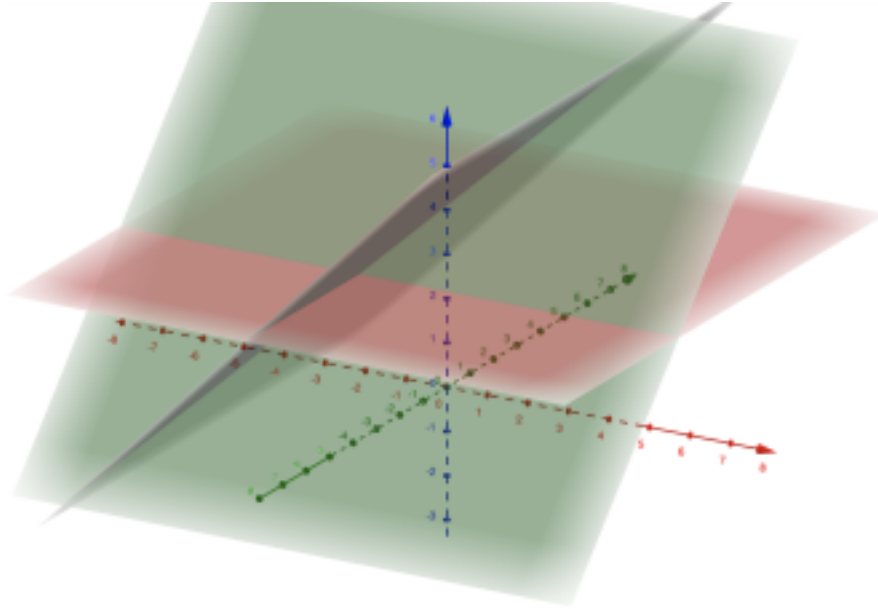
Figure 5. Terms of $4 \odot x \oplus 5 \odot y \oplus 3$ graphed in R^3.

Notice that the minimum is achieved by two or more terms at the point (-1, 2, 3) and the three rays extending from that point in the north, east, and southwest directions. Now, we project these minimums onto R^2. The resulting graph appears as shown in Figure 6. This graph is the hyperspace of $4 \odot x \oplus 5 \odot y \oplus 3$. Observe that the zero tension condition is obeyed in this example.
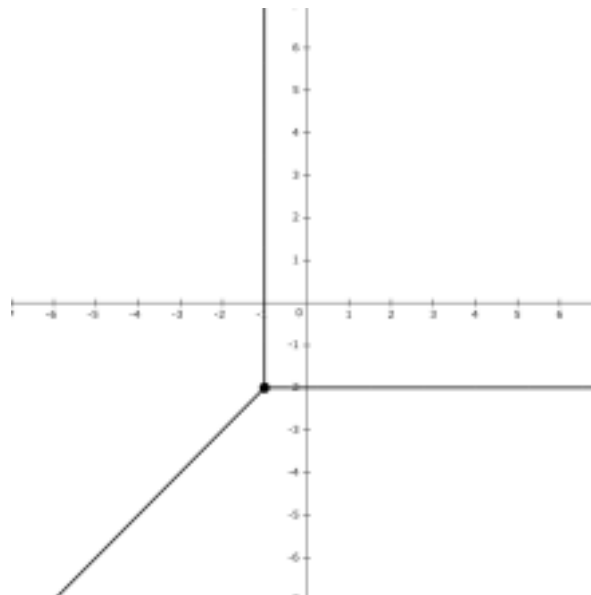
Figure 6. Graph of the hyperspace of $4 \odot x \oplus 5 \odot y \oplus 3$.

Thus, examining a graph of a hyperspace reveals that each line segment or ray represents when two terms of the tropical function are equal and minimized. When graphing hyperspaces, it can be useful to find triangulations first. Triangulations

Let us represent each term of a tropical polynomial p(x, y) as a point in R^3, where $k \odot x^i \odot y^j$ becomes (i, j, k). Next, find the convex hull of the resultant set of points. When viewing the convex hull, a three dimensional polytope, from the bottom, the hull would look like a polygon, with the upper polygonal faces subdividing this polygon Let us call this polygon P.
With this triangulation of the convex hull, we can find the graph of the hyperspace, H(p). H(p) will have a vertex in each polygon in the subdivision of P, an edge corresponding to each interior edge in the subdivision of P, and a ray corresponding to each boundary edge in the subdivision of P. Two vertices of H(p) are connected by an edge if and only if their corresponding polygons in the subdivision of P share an edge and the edge in P is perpendicular to the edge in the subdivision. The rays extending from a vertex in H(p) are perpendicular to their corresponding boundary edges in the subdivision of P. [Mor19]

5. Conclusion

Research on tropical geometry is ongoing. In fact, the foundations of tropical geometry are continually undergoing revision. Mathematicians are discovering new applications of tropical geometry to enumerative geometry and mirror symmetry. Tropical geometry is also used in studying computational algebraic geometry and purely combinatorical problems. [Kat17]
If you are interested in reading further into tropical geometry, I recommend reading Trop ical Mathematics by Bernd Sturmfels and David Speyer.

Works Cited

[Bra20] Madeline Brandt, What is tropical geometry?, 2020.

[Kat17] Eric Katz, What is...tropical geometry?, 2017.

[Mor19] Ralph Morrison, Tropical geometry, 2019.

[MR18] Grigory Mikhalkin and Johannes Rau, Tropical geometry, 2018.

[Rau17] Johannes Rau, A first expedition to tropical geometry, 2017.

[SS04] David Speyer and Bernd Sturmfels, Tropical mathematics, 2004.

[Zie07] G¨unter M. Ziegler, Lectures on polytopes, updated seventh printing of the first edition, 2007. Email address: may.jann.wong@gmail.com

To What Degree Did The Security Policy Changes Brought On By 9/11 Affect The General Spending On Security For Major Us Airports, And Do The Provided Benefits Outweigh The Cost? By Subkhankul Aripov

Abstract

Following the September 11 attacks, airport security in the United States was completely overhauled, with the US government spending billions of dollars every year to make sure that their airports remain safe. At such a high price, airport security remains a controversial topic, with many being doubtful of its effectiveness and economic sustainability. In this paper, data is used from a multitude of sources, including official US federal government financial reports, to depict the high cost of airport security measures that were added post 9/11.

Background

On September 11th 2001, 4 US commercial airline flights were hijacked by terrorists and purposefully crashed into multiple targets across the nation. American Airlines flight 11 along with United Airlines flight 175 were flown into the World Trade Center, a skyscraper complex in the heart of Manhattan. On the other side of the US, American Airlines flight 77 was flown into the Pentagon. Lastly, United Airlines flight 93 missed its target of Washington D.C and instead crashed into a Pennsylvania field due to the passengers and crew fighting off the terrorists (Dreher and Shalomov)[1]. According to Brittanica, the attack had resulted in the loss of 2,996 lives, including 17 terrorists. The events of that day also resulted in the US and the entire world completely overhauling their airport's security systems (Bergen)[2]. The purpose of this paper is to cover the economic impact brought upon by the enhancement of security measures across major US airports.

Introduction

Prior to the events of 9/11, airport security in the US was very different to the current system. A federal system that spanned the entire nation was not yet in place, with airports instead giving out contracts to private security companies that would be in charge of making sure that no passenger regulations were being violated. These contractors had lax security screenings, with the passengers having to only pass through a single metal detector without even needing to present any sort of identification along with their ticket when boarding the plane ("This Day in

TSA History")[3]. After the events of September 11th, the US government had come to a decision to federalize airport security through the means of the TSA, or Transportation Security Agency. Founded on November 19th, 2001, just 2 months after the terror attacks, the TSA was placed in charge of providing security to airports nationwide ("TSA History | Transportation Security Administration"). The TSA would be funded entirely by the federal government and would bear all responsibility for making sure that flights are safe from possible threats. Immediately after the founding of the TSA, a multitude of security measures were implemented that would require passengers as well as their bags to go through thorough x-ray inspection. These security measures were implemented across every single major commercial airport in the US, of which there are around 400.

Following 9/11, multiple other attempted terror attacks involving airplanes would occur, and each of those would lead the TSA to add more and more layers of security to airports. An example of this is the attempted shoe bombing by Richard Reid, that occurred on American Airlines flight 63 in December of 2001, just 3 months after 9/11. The terrorist had attempted to detonate explosive material that was inside of his boots, but was subdued by passengers and crew who noticed what he was doing ("Richard Reid's Shoes — FBI"). This event caused the TSA to begin requiring passengers to take off their shoes during security screenings and would be one of many new security procedures that would be added to US airports.

Due to the sheer amount of commercial airports in the US, and the number of technology and workforce size that is required to support this system, it would call for a large budget, as well as the reworking of airports to accommodate the extra security features.

This leads to my research question which is: *To what degree did the security policy changes brought on by 9/11 affect the general spending of major US airports?*

Finding data and using it to answer this question would provide a deep insight into how the events of a single day would affect the spendings of all major US airports going forward, and would help put into perspective how expensive the crucial security features are, and whether they are worth the money.

Methodology

To find the answer to my research question, I will be relying mostly on primary sources. Financial reports from US airports, as well as original TSA/DHS reports and budgets.

Aspects to research:	Why:
TSA annual budgets	To provide an insight into how much money is given to the TSA to provide security, and how that money is spent.
Security policies brought on by 9/11	To understand what type of changes were made to US airports and how the airports are impacted by the changes.
Spendings of major airports prior/post 9/11	To be able to compare and contrast an airport's budgeting before and after the new policies brought on by 9/11
TSA security reports	To be able to identify to which degree the changes were beneficial and whether they were worth it.

The Cost of the Changes

As mentioned previously, the TSA was founded in November of 2001, under the "Aviation and Transportation Security Act". The Bush administration had set its original budget to around $8 billion in its first year. Over the years, the budget has grown to around $10 billion, due to external factors like inflation along with internal factors like the addition of new security policies and wage increases. In 2003, the TSA was merged into the Department of Homeland Security as a sub-agency, where the TSA's budget would become part of the entire DHS budget.

Depicted below in image 1.0 is the TSA's proposed budget for the fiscal year 2023 by the Biden Administration. The image comes from the DHS' annual budget report. The budget totals to around $9.86 billion, up from the $8.135 billion of 2022. This is an increase of around $1.72 billion, or 21.7%.

Transportation and Security Administration
Budget Comparison and Adjustments
Appropriation and PPA Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2022 President's Budget	FY 2023 President's Budget
Operations and Support	**$8,135,506**	**$8,135,506**	**$8,451,537**	**$9,860,475**
Mission Support	$901,672	$901,672	$980,037	$1,042,958
Aviation Screening Operations	$5,497,847	$5,497,847	$5,709,431	$6,949,548
Screening Workforce	$4,082,668	$4,082,668	$4,158,822	$5,234,716
Screening Partnership Program	$226,406	$226,406	$231,068	$238,784
Screener Personnel, Compensation, and Benefits	$3,620,403	$3,620,403	$3,680,701	$4,732,094
Screener Training and Other	$235,859	$235,859	$247,053	$263,838
Airport Management	$651,622	$651,622	$721,038	$834,435
Canines	$169,513	$169,513	$170,186	$180,046
Screening Technology Maintenance	$477,711	$477,711	$532,300	$565,309
Secure Flight	$116,333	$116,333	$127,085	$135,042
Other Operations and Enforcement	$1,394,196	$1,394,196	$1,405,319	$1,550,219
Inflight Security	$784,655	$784,655	$774,332	$864,432
Federal Air Marshals	$764,643	$764,643	$754,069	$843,334
Federal Flight Deck Officer and Crew Training	$20,012	$20,012	$20,263	$21,098
Aviation Regulation	$238,468	$238,468	$246,416	$268,009
Air Cargo	$107,456	$107,456	$114,242	$127,746
Intelligence and TSOC	$76,497	$76,497	$83,554	$89,677
Surface Programs	$142,203	$142,203	$146,723	$156,639
Vetting Programs	$44,917	$44,917	$40,052	$43,716
Vetting Operations	$44,917	$44,917	$40,052	$43,716
Vetting Fees	$341,791	$341,791	$356,750	$317,750
TWIC Fee	$64,567	$64,567	$66,200	$63,100
Hazardous Materials Endorsement Fee	$18,126	$18,126	$19,200	$19,200
General Aviation at DCA Fee	$45	$45	$600	$600
Commercial Aviation and Airports Fee	$5,956	$5,956	$10,200	$10,000
Other Security Threat Assessments Fee	-	-	$50	$50
Air Cargo/Certified Cargo Screening Program Fee	$4,624	$4,624	$5,000	$5,000

TSA - 5

TSA's Budget Breakdown for the 2023 fiscal year, published by the DHS ("Transportation Security Administration Budget Overview").

Of those total $10.263 billion, $9.86 billion is spent on operations and support. This includes every single aspect of airport security, including staff and equipment. This part of the budget has been increasing year by year, going from $8.135 in 2021 to $8.451 billion in 2022, an increase of 316 million. The budget then has a much larger increase of $1.41 billion going from 2022 to 2023. This is an increase that is 445% larger than the increase of the previous year. According to Bloomberg, the increase comes from the plan to increase the wage of TSA agents, whose salaries were lower than those of other federal agencies. (Gilmer). To get a better understanding of the difference in the wage of a base-level TSA screening officer to other similar agencies, I researched the 2022 wages of a Customs and Border Protection (CBP) agent, as they are another sub-agency of the DHS. According to CBP's website, the starting salary for an agent is $42,516 per year ("CBP Officer Pay and Benefits | U.S"). Meanwhile, the average wage of a TSA agent was $32,408 ("TSA how much does it pay?"), a difference of $10,108 or 25.56%. This is a very significant number, and would explain why the TSA requested the White House

for such a large budget increase. By looking at the difference between the FY 2023 President's Budget and the FY 2022 President's budget, an upwards change of $1.24B can be seen in the "Screening Workforce" section. This supports the Washington Post's report that the salary of a TSA agent would be raised by around 28%, or $13,000 to approximately $37,500.

The increase in wage is very significant and greatly contrasts what airport security used to be like prior to 9/11, as according to Covenant Security, the largest remaining private airport security company that works in partnership with the TSA to provide security services at San Francisco International Airport, security guards prior to 9/11 who would man the standard x-rays would be paid minimum wage and would not receive any formal training. This means that inexperienced and low paid workers were the only security measures in place at US airports, and due to their lax policies and poor equipment, a terror attack was bound to occur ("About Us").

Aside from the human element of the security, the equipment plays the second most important role in the TSA's goal. Unfortunately, the TSA does not publically release how much it spends on screening technology, as many airports around the US feature different types of full body scanners and baggage x-rays that may have different maintenance and upfront costs. Since 2001, the TSA has utilized a variety of different screeners and scanners across US airports, the estimated price of the standard full body scanner like the one pictured below is estimated to be $150,000 per unit ("TSA Full Body Scanner").

TSA ProVision full body scanner.

Due to the fact that this technology can last many years, it is hard to pinpoint when exactly the TSA placed their order for it and how much they paid. As of 2021, the only public statement from the US government regarding the purchase of new screening technology came when the TSA announced that it was placing a $120 million order for the "Analogic ConneCT", a brand new baggage screening device developed by the Analogic Corporation which mostly manufactures medical devices such as x-rays. According to their site, one of these units costs around $350,000 and can scan 600 bags per hour ("Checkpoint - Analogic").

It is safe to assume that the TSA has spent over $1B on screening technology since 9/11, as this one minor already exceeds $100 million.

The $7.78B average annual TSA budget that is spent on the aforementioned sectors, as well as the dozen other aspects of their operations is decided on by congress and approved by the POTUS, but it is not the only way that the TSA earns money. The security policy changes that came as a result of 9/11 also came at a price for the passengers, although a minimal one. The

September 11 Security Fee is a $5.20 tax that is included [1]on every airline ticket that is sold for flights bound or leaving the US, meaning that a passenger, both domestic and international would pay $11.20 for a roundtrip flight to the US. As seen in image 3.0, the TSA had collected $995.4 million from passengers in the first year of the program. This number has more than tripled since 2002, up to $3.786 in 2022. The collected funds are used for maintenance and upgrades of security equipment in airports that are in need of improvement.

WIth all of this information in mind, the US has spent well over $100B on airport security since 9/11, making it one of the DHS' most expensive subdivisions. Over the years, the quality of the security provided by the TSA has been scrutinized, with people doubting that their tax money is going to a worthy cause. But how effective is the TSA?

Does the TSA work?

To answer the question of whether the benefits of the TSA outweigh the massive financial cost, multiple factors must be considered. The first being the TSA's main goal. The TSA's motto is "**Protect the nation's transportation systems to ensure freedom of movement for people and commerce**." This means that the TSA's services should be successfully stopping any threats, while also not needlessly slowing the travel of people and goods around the world.

In 2017, the OIG, or the Office of Inspector General conducted covert testing of the TSA's security procedures. These tests involved sending undercover agents through security with fake hidden weapons, explosives and other prohibited items to see if they were going to be detected. The results of the tests showed that the TSA's failure rate of being able to stop a person carrying illegal items is around 70%, which is down from the astonishing 95% fail rate of a similar test conducted internally in 2015. ("Aviation Security: TSA Improved Covert Testing but Needs to Conduct More Risk-Informed Tests and Address Vulnerabilities"). This number sparked outrage in the media, with multiple large news sites reporting on the TSA's failure. In fact, the acting director of the TSA at the time had resigned over the controversy ("TSA Director Resigns"). This called into question the usefulness of the TSA, and called for potential reform of its operations. The TSA's whole existence has been controversial seeing as they have never stopped any terrorists since its founding, but has caused inconvenience to millions of passengers worldwide in the name of safety. This mostly comes down to the fact that most terror plots

---

1

involving aircraft or airports are stopped by other agencies like the CIA or FBI prior to the terrorists even reaching the airport.

On the other hand, the TSA has been successful in stopping passengers from boarding planes with weapons, though none of these weapons can be proven to have been taken through security with any malicious intent, the TSA had confiscated 6,201 firearms in 2022 alone, most of which were loaded with ammunition. This means that the TSA, even with its high failure rate does play a role in making sure that no one brings prohibited items on board aircraft. Another reason why the TSA is valuable to the security of US airports is that it serves as a deterrent against potential attackers who may be dissuaded by the amount of layers of security present in the airport, even if those layers may not be very effective statistically. The presence of the TSA and its screening procedures may also provide comfort to weary passengers who may be concerned about potential attacks.

Conclusion

Due to the overhaul of airport security post 9/11, and the founding of the TSA, the cost of airport security has been taken from individual airports and been passed onto the US government, and in turn the taxpayers. Though this program does come at a high cost, the security levels of all US airports has greatly increased, with there being 60,000 trained TSA agents who are being paid a liveable wage and utilize the latest technology in an attempt to prevent terrorism in US airports and US flights, as opposed to the previous system of using minimum wage employees with poor equipment to screen passengers. The events of 9/11 had greatly impacted not only the spending of US airport security, but the general outlook on security in public areas.

Therefore, the changes to airport security policy post 9/11 had major impacts on how much money is spent on security, as well as where that money comes from. Whether or not the benefits outweigh the costs is a controversial question, whose answer will vary from person to person, but objectively the TSA has performed its duties of securing US airports efficiently, though not to a great extent.

Works Cited

"About Us." *Covenant Aviation Security*,

  https://www.covenantsecurity.com/about.html#ourHistory. Accessed 29 January 2023.

"Aviation Security: TSA Improved Covert Testing but Needs to Conduct More Risk-Informed

  Tests and Address Vulnerabilities." *GAO*, 4 April 2019,

  https://www.gao.gov/products/gao-19-374. Accessed 29 January 2023.

Bergen, Peter L. "September 11 attacks | History, Summary, Location, Timeline, Casualties, &

  Facts." *Encyclopedia Britannica*, 30 November 2022,

  https://www.britannica.com/event/September-11-attacks. Accessed 20 January 2023.

"CBP Officer Pay and Benefits | U.S." *Customs and Border Protection*,

  https://www.cbp.gov/careers/ofo/pay-benefits/cbpo. Accessed 28 January 2023.

"Checkpoint - Analogic." *Analogic Corporation*,

  https://www.analogic.com/imaging-and-detection/checkpoint/?locale=en. Accessed 28

  January 2023.

Dreher, Amy, and Yulia Shalomov. "Meaningful Adjacencies: The Brave Flight Crews of 9/11 |

  National September 11 Memorial & Museum." *911 Memorial*,

  https://911memorial.org/connect/blog/meaningful-adjacencies-brave-flight-crews-911.

  Accessed 26 January 2023.

"An Economic Study of the US Post-9/11 Aviation Security." *Scientific Research Publishing*,

  https://www.scirp.org/journal/paperinformation.aspx?paperid=102057. Accessed 20

  January 2023.

"Forbes." *YouTube*, 10 August 2022,

  https://www.forbes.com/sites/realspin/2011/11/18/ten-years-of-the-tsa-yes-it-seems-much

  -longer/?sh=1d4ef3ae1932. Accessed 24 January 2023.

Gilmer, Ellen M. "Longer Lines at Airports Loom Without Pay Boost for TSA Officers |

  Bloomberg Government." *Bloomberg Government*, 3 November 2022,

  https://about.bgov.com/news/longer-lines-at-airports-loom-without-pay-boost-for-tsa-offi

  cers/. Accessed 28 January 2023.

"Richard Reid's Shoes — FBI." *FBI*, https://www.fbi.gov/history/artifacts/richard-reids-shoes.

  Accessed 26 January 2023.

"Security Fees." *Transportation Security Administration*,

      https://www.tsa.gov/for-industry/security-fees. Accessed 29 January 2023.

"Ten Years of The TSA." *Forbes*,

      https://www.forbes.com/sites/realspin/2011/11/18/ten-years-of-the-tsa-yes-it-seems-much

      -longer/?sh=1d4ef3ae1932.

"This Day in TSA History." *TSA.gov*, Transportation Safety Agency,

      https://www.tsa.gov/about/employee-stories/day-tsa-history-november-19-2001.

"Transportation Security Administration Budget Overview." *Homeland Security*,

      https://www.dhs.gov/sites/default/files/2022-03/Transportation%20Security%20Administ

      ration_Remediated.pdf. Accessed 26 January 2023.

"TSA Director Resigns." *CNN*,

      https://edition.cnn.com/2016/06/22/politics/kelly-hoggan-resignation-tsa/index.html.

      Accessed 29 January 2023.

"TSA Full Body Scanner." *YouTube*, 10 August 2022,

      https://eu.usatoday.com/story/travel/roadwarriorvoices/2015/08/17/tsa-has-spent-160-mill

      ion-on-body-scanners-and-theyre-still-terrible/83288622/. Accessed 28 January 2023.

"TSA History | Transportation Security Administration." *TSA*, https://www.tsa.gov/history.

      Accessed 20 January 2023.

"TSA, how much does it pay?" *Indeed*,

      https://www.indeed.com/cmp/TSA-(transportation-Security-Administration)/salaries.

      Accessed 28 January 2023.

Investigating Data Augmentation Strategies for Computer Vision Facial Expression Recognition By Jack Liu

Abstract

Autism is a neurodevelopmental disorder. A major symptom is a difficulty communicating and understanding social cues such as emotions. I aim to help people with autism better recognize emotions by developing improved artificial intelligence (AI) models to recognize facial expressions. Such models can be and have been integrated into digital therapeutics for children with autism. A crucial step to achieving performant models is to apply data augmentation to increase the dataset size and the generalization capacity. I compare and contrast data augmentation strategies on the Facial Expression Recognition (FER) 2013 dataset to determine which method leads to a maximal increase in performance. I then examine the benefit of data augmentation at various training set sizes. Among the strategies I evaluate, I find that shifting the width of the image provides the greatest increase in performance when compared to not applying data augmentation. Furthermore, I find that at several training dataset sizes ranging from 100 to 20,000 images, applying all data augmentation strategies consistently outperforms no data augmentation. These strategies can inform the development of digital therapies for autism which focus on the evocation and subsequent automatic detection of facial expressions.

Introduction

Autism spectrum disorder (ASD) is a developmental disorder caused by genetic and environmental factors that can cause difficulties in communicating, repetitive behaviors, particular interests, sensory processing difficulties, speech or cognitive issues, and other characteristic behaviors [1,2]. These effects cause autistic people to act, interact, and learn differently than others [3]. Autism affects around 1 in 44 people in the United States [4]. Signs of autism can appear when a child is around 2 or 3 years old but can be detected within 18 months of birth [5]. Autism affects everyone differently with some still being high-functioning and being able to live independently, while others may need a lot of assistance or are severely challenged [5].

Symptoms and effects of autism vary across individuals, but some people with autism may find trouble recognizing emotions effectively and communicating with others [3-4]. For example, they may be unable to maintain eye contact, unable to effectively use hand gestures, have scripted speech patterns, or struggle to make friends [3-4]. As a result of struggling to communicate, they may feel ostracized or lonely and are more likely to develop conditions such as anxiety and depression [3-4]. When people with autism are unable to identify emotional cues, it is a condition known as alexithymia [5]. Around half of all people with autism also have alexithymia [5]. Studies have shown that many autistic people with alexithymia know that they are experiencing some sort of emotion, but are unable to identify and react to it [6]. Therefore, facial emotion AI could potentially be used to help these children better understand and recognize the emotions of others, which could improve their social interactions. In addition, it can be used to provide feedback to children with autism about their own emotional expressions. This could help them learn to better understand and regulate their own emotions as well as recognize the emotions of others.

A multitude of researchers has made innovations in the development and application of emotion recognition AI models towards providing remote, scalable, and accessible therapy to children with autism. For example, the SuperpowerGlass project is a digital device that relays real-time social cues to the wearer [7-12]. The device uses Google Glass to scan faces and sends the detected facial expressions and emotions to a smartphone app [13].

Data augmentation is a technique used to artificially increase the size of a dataset by generating new data samples from the existing ones, for example rotating, cropping, or flipping them. This can improve the performance of machine learning models. It is especially important when the given dataset is small and the model needs a large dataset to train with.

In this work, I trained a machine learning model using the FER 2013 dataset and applied several data augmentation strategies to understand which strategy would provide the highest performance gains to my AI model. The data augmentation strategies I experimented with were featurewise center, featurewise standard normalization, zero-component analysis whitening, zero-component analysis epsilon, rotation, width shift, and height shift. I then measured the accuracy, precision, and recall of this model on a held-out test dataset from FER 2013 to determine how useful or efficient the data augmentation strategies are. Among the strategies I evaluated, I found that shifting the width of the image provided the greatest increase in

performance when compared to no data augmentation. Furthermore, I found that at several training dataset sizes ranging from 100 to 20,000 images, applying all data augmentation strategies consistently outperformed not applying data augmentation.

Related Work

I reviewed the most recent literature describing facial emotion recognition using computer vision techniques. I selected works that explicitly document the data augmentation strategies used. The selected works discussed employ the following data augmentation strategies: Signal-based Audio Augmentation (SA), SA with replacement (SAR), SA with replacement of the majority class only (SARM), SAR adding only Background Noise (SARB), SAR using only TS and PS (SARS), face detection crop, grayscale conversion, image normalization, image augmentation, rotation, reflection, flip, scale, shift, noise, color jitter, random erasing, mirroring, rescaling, geometric transformations, linear transformations, flipping, and mixing images together. The range of emotions tested for is anger, disgust, fear, happiness, sadness, surprise, and neutrality. Accuracy percentages ranged from 53% to 97%. Chatziagapi et al. proposed a General Adversarial Network (GAN) to deal with the issue of data imbalance in Speech Emotion Recognition (SER) on the emotions of anger, happiness, and sadness. The data augmentation strategies that were analyzed were sample copying (CP), signal-based audio augmentation (SA), SA with replacement (SAR), SA with replacement of the majority class only (SARM), SAR adding only background noise (SARB), and SAR using time stretch (TS) and pitch shift (PS) (SARS) with a dataset consisting of many spectrograms. These researchers reached an accuracy of 53.6% with data augmentation and 49.0% accuracy without data augmentation [14]. Ahmed et al. developed a facial expression classifier on 5 popular emotion recognition datasets and studied the effect of horizontal flipping, rotating, rescaling, shearing, and zooming as data augmentation strategies. The authors reached 96.24% accuracy with data augmentation and 92.95% accuracy without data augmentation [15]. Tong et al. created improved convolution neural networks by using second-order pooling. Because they had a small dataset, they applied data augmentation strategies to enhance the training process. Their group obtained an 88.625% accuracy with data augmentation [16]. Xu et al. investigated bias and fairness in facial recognition AI while applying data augmentation strategies to the RAF-DB and CalebA datasets. They achieved an accuracy of up to 74.8% with data augmentation and 62.2% without data augmentation [17].

Sajjad et al. implemented different algorithms for face and emotion detection. They also used data augmentation to improve training within their dataset. They reached an 80.5% validation accuracy without data augmentation and 94% with data augmentation [18]. Yang et al. researched and developed a model to scan and identify if someone is angry, disgusted, fearful, happy, sad, or surprised. They implemented pre-processing approaches like face detection, rotation rectification, and data augmentation during training. They achieved a 97.02% accuracy with the CK+ dataset, 92.21% with the JAFFE dataset, and 92.89% with the Oulu-CASIA dataset [19]. Khaireddin and Zhuofa used the VGGNet Architecture in this work along with rescaling, shifting, and rotating images in the dataset to experiment with optimization. The emotions analyzed were anger, disgust, fear, happiness, sadness, surprise, and neutrality, and they achieved 73.28% accuracy [20]. Zhu et al. analyzed emotion classification using GAN-based data augmentation techniques. The new images generated after data augmentation techniques were applied were a combination of high-level facial features from the original images. The emotions that were analyzed were neutral, fear, anger, disgust, sadness, happiness, and surprise. The experiments saw a 5% to 10% increase in accuracy after data augmentation was applied [21]. Tan et al. researched group facial recognition using different convolutional neural networks. They achieved an accuracy of 80.9% on the test set [22]. Psaroudakis and Kollias experimented with data augmentation strategies to propose a newer, more effective data augmentation strategy in relation to emotion recognition. The precision, recall, and F1 scores increased by 10%, 5%, and 6% when their data augmentation strategy was applied [23].

Methods

To perform my experiments, I implemented a MiniVGGNet convolutional neural network (CNN) implemented in TensorFlow. I did not make any modifications to this base architecture except to replace the final layer with a fully connected layer with 7 nodes, one per emotion, with softmax activation. I optimized the model with categorical cross-entropy loss.

A crucial step to achieving performant models is to apply data augmentation to increase the dataset size and the generalization capacity. I compared and contrasted data augmentation strategies on the Facial Expression Recognition (FER) 2013 dataset, which consists of 48x48 grayscale images of faces, to determine which method leads to a maximal increase in performance. I compared the following data augmentation strategies (Figure 1): featurewise

center, featurewise standard normalization, zero-component analysis whitening, zero-component analysis epsilon, rotation, width shift, and height shift. I then examined the benefit of data augmentation at various training set sizes, ranging from 100 images to 20,000 images.

To increase my confidence about my results, I applied 5 iterations of bootstrapped sampling to each condition and measured the mean and standard deviation of the bootstrapped samples.
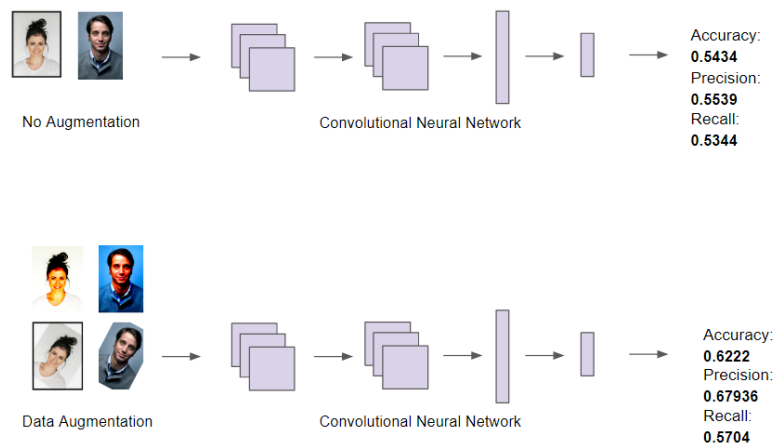
Figure 1. Summary of the experimental procedures. A convolutional neural network (CNN) is trained with and without data augmentation. The accuracy, precision, and recall on a held-out test set are compared for both models.

Results

When comparing data augmentation strategies, I found that the best-performing strategy was the width shift with a mean accuracy of 59.192% (Table 1). The worst-performing strategies were samplewise centering and samplewise standard normalization with a mean accuracy of 26.018% and 29.166% respectively (Table 1). However, there was no significant difference across augmentation strategies besides the significantly lower percentages for the samplewise centering and samplewise standard normalization.

Data augmentations that were used	Test accuracy (note: this is the val_accuracy at epoch 50 / the last epoch)
Featurewise Centering	0.54654 +/- 0.00862

Samplewise Centering	0.26018 +/- 0.02680
Featurewise Standard Normalization	0.54850 +/- 0.01064
Samplewise Standard Normalization	0.29166 +/- 0.03539
Zero-phase Component Analysis Whitening	0.54906 +/- 0.00366
Zero-phase Component Analysis Epsilon	0.55304 +/- 0.00587
Rotation Range	0.58722 +/- 0.00733
Width Shift Range	0.59192 +/- 0.00596

Table 1. Test accuracy (mean +/- standard deviation) on a held-out set from FER 2013 for several data augmentation strategies.

I also compared the effect of training set size on the effect of data augmentation (Table 2). I found that at all training set sizes, the performance metrics are consistently higher with data augmentation applied compared to when data augmentation is not applied.

Training set size	Accuracy (mean +/- stdev)		Precision (mean +/- stdev)		Recall (mean +/- stdev)	
	No augmentation	All augmentation strategies	No augmentation	All augmentation strategies	No augmentation	All augmentation strategies
100	0.1766 +/- 0.00951	0.24048 +/- 0.00667	0.1839 +/- 0.01328	0.24846 +/1 0.00818	0.11774 +/- 0.01793	0.20772 +/- 0.00786
200	0.26 +/- 0.01377	0.27664 +/- 0.01235	0.2854 +/- 0.01225	0.28654 +/- 0.01484	0.2221 +/- 0.00937	0.24446 +/- 0.01491
500	0.2945 +/- 0.00489	0.3337 +/- 0.00830	0.32022 +/- 0.00550	0.3461 +/- 0.00875	0.2403 +/- 0.00312	0.31176 +/- 0.00739

1000	0.34788 +/- 0.00557	0.3917 +/- 0.01526	0.37432 +/- 0.00400	0.40582 +/- 0.01479	0.30412 +/- 0.00517	0.37418 +/- 0.01699
2000	0.383 +/- 0.00725	0.4474 +/- 0.00299	0.40694 +/- 0.00990	0.46238 +/- 0.00461	0.36326 +/- 0.02382	0.4286 +/- 0.00400
5000	0.434 +/- 0.00711	0.53128 +/- 0.00296	0.45064 +/- 0.00738	0.54636 +/- 0.01098	0.41826 +/- 0.00653	0.51674 +/- 0.00568
10,000	0.4853 +/- 0.00735	0.588 +/- 0.00130	0.50388 +/- 0.00939	0.60518 +/- 0.00279	0.47204 +/- 0.00455	0.57 +/- 0.00255
15,000	0.5066 +/- 0.00890	0.6192 +/- 0.00287	0.52106 +/- 0.00989	0.63532 +/- 0.00256	0.4882 +/- 0.00866	0.6024 +/- 0.00354
20,000	0.5434 +/- 0.00552	0.6222 +/- 0.00331	0.5539 +/- 0.00533	0.67936 +/- 0.00171	0.5344 +/- 0.00468	0.5704 +/- 0.00795

Table 2. Comparison of data augmentation vs. no data augmentation for various training set sizes.

Discussion and Conclusion

The primary finding of this work is that data augmentation consistently improves the performance of an emotion recognition computer vision model regardless of the amount of training data used. From the quantification of the marginal utility of some of the most popular image-based data augmentation approaches for computer vision, I found that including out-of-the-box augmentation strategies can yield detrimental performance, likely due to maladaptive distribution shifts.

There are increasing efforts to build state-of-the-art emotion recognition models for digital therapies and behavioral phenotyping for increased automation of screening and detection tools [24-32]. Ultimately, the strategies I explored in this work can inform the development of

digital therapies for autism which focus on the evocation and subsequent automatic detection of facial expressions.

The primary limitation of this study was the reduced selection of data augmentation strategies and the use of only a single emotion recognition dataset for both training and evaluation. In future iterations of this work, I will evaluate additional data augmentation strategies for an expanded array of emotions. It would also be fruitful to explore generative models for data augmentation using variational autoencoders or generative adversarial networks [33-35].

Works Cited

"Signs and Symptoms of Autism Spectrum Disorders." *Centers for Disease Control and Prevention*, 9 Dec. 2022, www.cdc.gov/ncbddd/autism/signs.html.

"What Is Autism?" *Autism Speaks*, www.autismspeaks.org/what-autism.

"What Is Autism Spectrum Disorder?" *Centers for Disease Control and Prevention*, 9 Dec. 2022, www.cdc.gov/ncbddd/autism/facts.html.

"What Is Autism Spectrum Disorder?" *American Psychiatric Association*, https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder.

Dattaro, Laura. "Difficulty Identifying Emotions Linked to Poor Mental Health in Autistic People: Spectrum: Autism Research News." *Spectrum*, 12 Nov 2020, www.spectrumnews.org/news/difficulty-identifying-emotions-linked-to-poor-mental-health-in-autistic-people/.

Brewer, Rebecca, and Jennifer Murphy. "People with Autism Can Read Emotions and Feel Empathy." *Spectrum*, 12 July 2016, www.spectrumnews.org/opinion/viewpoint/people-with-autism-can-read-emotions-feel-empathy/.

Kline, Aaron, et al. "Superpower glass." *GetMobile: Mobile Computing and Communications* 23.2 (2019): 35-38.

Voss, Catalin, et al. "Superpower glass: delivering unobtrusive real-time social cues in wearable systems." *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct*. 2016.

Voss, Catalin, et al. "Effect of wearable digital intervention for improving socialization in children with autism spectrum disorder: a randomized clinical trial." *JAMA pediatrics* 173.5 (2019): 446-454.

Daniels, Jena, et al. "Exploratory study examining the at-home feasibility of a wearable tool for social-affective learning in children with autism." *NPJ digital medicine* 1.1 (2018): 32.

Washington, Peter, et al. "SuperpowerGlass: a wearable aid for the at-home therapy of children with autism." *Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies* 1.3 (2017): 1-22.

Washington, Peter, et al. "SuperpowerGlass: a wearable aid for the at-home therapy of children with autism." *Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies* 1.3 (2017): 1-22.

Kulkarni, Nitish. "Stanford Researchers Treat Autism with Google Glass." *TechCrunch*, 19 Oct. 2015, techcrunch.com/2015/10/19/stanford-researchers-treat-autism-with-google-glass/.

Chatziagapi, Aggelina, et al. "Data Augmentation Using GANs for Speech Emotion Recognition." *Interspeech*. 2019.

Ahmed, Tawsin Uddin, et al. "Facial expression recognition using convolutional neural network with data augmentation." *2019 Joint 8th International Conference on Informatics, Electronics & Vision (ICIEV) and 2019 3rd International Conference on Imaging, Vision & Pattern Recognition (icIVPR)*. IEEE, 2019.

Tong, Xiaoyun, Songlin Sun, and Meixia Fu. "Data augmentation and second-order pooling for facial expression recognition." *IEEE Access* 7 (2019): 86821-86828.

Xu, Tian, et al. "Investigating bias and fairness in facial expression recognition." *European Conference on Computer Vision*. Springer, Cham, 2020.

Sajjad, Muhammad, et al. "Human behavior understanding in big multimedia data using CNN based facial expression recognition." *Mobile networks and applications* 25.4 (2020): 1611-1621.

Yang, Biao, et al. "Facial expression recognition using weighted mixture deep neural network based on double-channel facial images." *IEEE access* 6 (2017): 4630-4640.

Khaireddin, Yousif, and Zhuofa Chen. "Facial emotion recognition: State of the art performance on FER2013." *arXiv preprint arXiv:2105.03588* (2021).

Zhu, Xinyue, et al. "Emotion classification with data augmentation using generative adversarial networks." *Pacific-Asia conference on knowledge discovery and data mining*. Springer, Cham, 2018.

Tan, Lianzhi, et al. "Group emotion recognition with individual facial emotion CNNs and global image based CNNs." *Proceedings of the 19th ACM International Conference on Multimodal Interaction*. 2017.

Psaroudakis, Andreas, and Dimitrios Kollias. "MixAugment & Mixup: Augmentation Methods for Facial Expression Recognition." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2022.

Carpenter, Kimberly LH, et al. "Digital behavioral phenotyping detects atypical pattern of facial expression in toddlers with autism." *Autism Research* 14.3 (2021): 488-499.

Chi, Nathan A., et al. "Classifying Autism from Crowdsourced Semi-Structured Speech Recordings: A Machine Learning Approach." *arXiv preprint arXiv:2201.00927* (2022).

Egger, Helen L., et al. "Automatic emotion and attention analysis of young children at home: a ResearchKit autism feasibility study." *NPJ di*

Kalantarian, Haik, et al. "A mobile game for automatic emotion-labeling of images." *IEEE transactions on games* 12.2 (2018): 213-218.

Kalantarian, Haik, et al. "Guess What? Towards Understanding Autism from Structured Video Using Facial Affect." *Journal of healthcare informatics research* 3 (2019): 43-66.

Penev, Yordan, et al. "A mobile game platform for improving social communication in children with autism: a feasibility study." *Applied clinical informatics* 12.05 (2021): 1030-1040.

Sapiro, Guillermo, Jordan Hashemi, and Geraldine Dawson. "Computer vision and behavioral phenotyping: an autism case study." *Current Opinion in Biomedical Engineering* 9 (2019): 14-20.

Washington, Peter, et al. "Improved Digital Therapy for Developmental Pediatrics Using Domain-Specific Artificial Intelligence: Machine Learning Study." *JMIR Pediatrics and Parenting* 5.2 (2022): e26760.

Washington, Peter, et al. "Training an emotion detection classifier using frames from a mobile therapeutic game for children with developmental disorders." *arXiv preprint arXiv:2012.08678* (2020).

Antoniou, Antreas, Amos Storkey, and Harrison Edwards. "Data augmentation generative adversarial networks." *arXiv preprint arXiv:1711.04340* (2017).

Calimeri, Francesco, et al. "Biomedical data augmentation using generative adversarial neural networks." *Artificial Neural Networks and Machine Learning–ICANN 2017: 26th*

International Conference on Artificial Neural Networks, Alghero, Italy, September 11-14, 2017, Proceedings, Part II 26. Springer International Publishing, 2017.

Zhu, Xinyue, et al. "Emotion classification with data augmentation using generative adversarial networks." *Advances in Knowledge Discovery and Data Mining: 22nd Pacific-Asia Conference, PAKDD 2018, Melbourne, VIC, Australia, June 3-6, 2018, Proceedings, Part III 22*. Springer International Publishing, 2018.

Observational Scoliosis Diagnosis with Deep Learning By Penelope Larkin

Abstract

This research explores the possibility of diagnosing scoliosis with high accuracy from a single photo of a person's back taken with a consumer-grade camera, like a simple smartphone, instead of using an X-ray. The model is 76% successful on the validation set and the class activation maps confirm the model is learning medically relevant features. This model could be used in communities or countries where access to X-rays is limited or where medical staff has not been trained to detect scoliosis. Additionally, reducing the number of X-rays needed to assess and monitor patients' conditions would lower costs and limit exposure to radiation. This notebook is a self-directed research project.

Methods

I performed this research in a "Jupyter notebook" which combines text, images, code, and output. I built a computer vision model using PyTorch and the fastai framework and trained it on a small public dataset of 14 images and 50 images I collected myself via Google image search. Given the small number of images, I employed a "transfer learning" approach and used a convolutional neural network (ResNet18) which was pre-trained on the ImageNet dataset. I withheld 33% of the images as a validation set and fine-tuned the model on the remaining images. To ensure robustness and avoid overfitting, I used randomized data augmentation transformations: left-to-right image flipping, slight rotations, brightness adjustments, and "MixUp."

Model Creation and Training

I instantiated the model, a Fastai vision_learner, by passing in the Dataloader, the model architecture, and the metrics we want displayed in training. For the model architecture, I chose the ResNet18. The ResNet was introduced in 2015 by Kaiming He et al. and introduced the skip connection where each subsequent model layer is provided with the residual of the prior layer. Before this innovation, it was known in theory that deeper networks should be better, but that was not observed in practice. The ResNet architecture allows the network to learn more complex features while still being able to effectively optimize a model with a large number of layers

during training. The "18" refers to the number of convolutional layers in the model. Fastai also adds a modified model head. ResNet18 is trained for the 1,000 ImageNet classes. In this dataset, there are two prediction classes: "Yes" or "No" for diagnosis. As such, Fastai removes the fully connected and softmax layers from the pretrained model and replaces them with a two class softmax and appropriately sized fully connected layer. Fastai also adds two layers of "dropout" to make the model more robust to overfitting. By default, when training, Fastai uses a cyclical learning rate, the Adam optimizer, batch normalization, and random initial weights in the head.

In addition to using the accuracy as a metric, I also showed the F1 Score because the classes are imbalanced in this dataset. The F1 Score is the harmonic mean between the precision, P, which answers "What proportion of positive identifications was actually correct?", and the recall, R, which answers "What proportion of actual positives was identified correctly?".

A higher F1 score is better and the maximum of the metric is 1.0. During fine-tuning, I used "MixUp" which combines the images and their labels which is a helpful data augmentation technique when the dataset is small. "MixUP" is described in the paper by Zhang, Hongyi, et al.

I fine-tuned the model to adjust the weights and to teach the model the differences between my dataset and the ImageNet dataset. I trained for 9 epochs. The output of the model at the final epoch is represented in Figure 1

Model Validation and Explainability; Class Activation Maps

The confusion matrix shows the count of true positives and true negatives on the diagonal and count of errors elsewhere. While the model was not perfect, the true positives and true negatives far exceed the false positives and false negatives.

Figure 2: Confusion Matrix
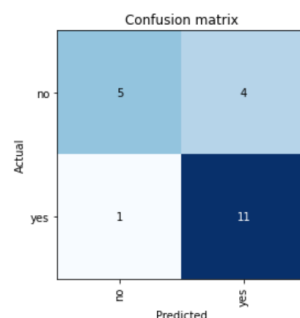
It is not just necessary to validate the model on the validation set using metrics, but also to be able to explain why the model comes to its conclusion. It is important to ensure that the model is not learning features that are not, in fact, important to the problem. For example, in one paper, *"Why Should I Trust You?": Explaining the Predictions of Any Classifier*, the authors trained a classifier to distinguish between wolves and huskies (which look very similar to the untrained eye). The model appears to work well when looking at the metrics on the validation set, but in fact, the distinguishing feature it learns is that in the images of wolves, there is snow! That model therefore is simply classifying an image with snow as a wolf and an image without snow as husky.

In the notebook, I use the class activation map (CAM), introduced by Bolei Zhou et al. in *Learning Deep Features for Discriminative Localization*. This method uses the output of the last convolutional layer and class weights from the final linear layer to display a heatmap visualization of why the model made its decision. The output of the last convolutional layer contains all the final feature maps that the model thinks are important to make the classification. CAM shows how each pixel in the image contributed to the model class prediction. To do this, it takes the feature maps from the last convolutional layer and does a weighted sum via "Einstein summation" where the weights are the learned weights in the final fully connected layer for the predicted class. This weighted sum is then overlaid onto the image.

Figure 3: Class Activation Maps for "No" and "Yes" Images
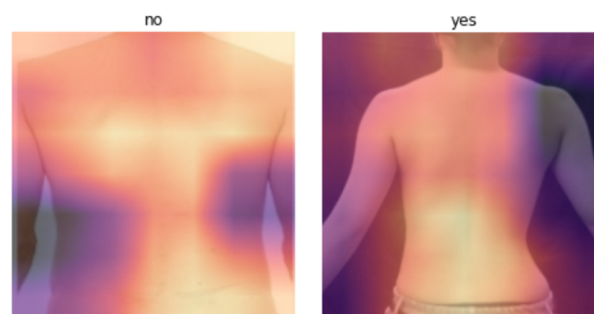
Above in Fig. 3, I present two CAM images for a negative and positive class. These CAM images are very encouraging because we can see that in both a positive and negative prediction, the model looks primarily at areas of the back that make sense for scoliosis diagnosis: the shoulder blades and spine.

Limitations, Ethical Considerations, and Next Steps

  The dataset I am using is made up, in part, by a dataset published in Kaggle Datasets, however there is no provenance or description, and I do not know the circumstances under which the data was collected. I have contacted the publisher of the dataset to get clarity on these questions but have not heard back. The remainder of the data I collected via Google image search. Likewise, we cannot be certain if these images were accurately classified. Because of lack of clarity on the data, the results presented here can only be considered preliminary and this research notebook should be considered a proof-of-concept. This study should be repeated on a dataset where the images and labels have been collected and validated by trained medical staff. Additionally, the dataset should contain diverse images across gender, race, and skin color in order to ensure that the model is not biased. A follow-up study that could be done is to see if a model can accurately measure the Cobb angle (degree of the spinal curvature) from photos. To conduct this study, we would need actual curve measurements in addition to class labels. I hope to work with a pediatric orthopedics group at a hospital to further this work.

An Exploration of Familial Relationships Within Young Adult Dystopian Films By Amber Lu

Introduction

While dystopian works have existed in media and popular culture since the mid-1900s, their popularity has escalated sharply throughout the twenty-first century. A particular subcategory developing within the broader genre of "dystopia" is the young adult (YA) dystopia. Often a sort of coming-of-age tale and characterized by the inclusion of a "young adult" or teenage protagonist, the genre has grown increasingly popular, boasting blockbuster franchises and bestselling book series, many of which have been published in the past two decades. The *Hunger Games* franchise, the *Divergent* trilogy, and the *Maze Runner* trilogy–which are all film adaptations of popular novels–are just a few examples of film franchises that have enjoyed widespread recognition as acclaimed works of this genre.

The popularity of YA dystopian literature is undoubtedly what gave way to the rise of films of the same genre. While the trend of young adult dystopian book-to-film adaptations has lessened slightly toward the end of the last decade, newer films such as *The Darkest Minds* (2018) and *Ready Player One* (2018) continue to maintain the genre's popularity, albeit not as successfully as their slightly older predecessors.

Even so, the success of the YA dystopian genre cannot completely be attributed to its popularity among young fans. In fact, a 2015 study by Nielsen revealed that "80% of all the YA books that are selling are being bought by adults." (Gilmore) The fanbase for these franchises is diverse in age range because "YA dystopian fiction is not simply an imitation of classical dystopian fiction with younger protagonists." (Hemphill 5) As the genre has developed through the years, it has become much more than just stories about teenagers overthrowing the tyrannical government. Now, distinctive marks of the YA dystopia can include "influences from war, love, action, adventure, and even espionage stories, creating a fast-paced plot that appeals to young readers." (Hemphill 5) These unique influences are what set this genre apart and give it the capacity to impact audiences on a deeper level. Contemporary YA dystopian films are regarded as much more complex pieces of media containing real-world implications and social critique. And this reveals the larger and more general appeal of dystopian stories: "Though ostensibly set in the future, the post-apocalyptic mode can function as a window on, and critique of, the present." (Schmidt)

Framework

Dystopia is defined by Merriam-Webster as "an imagined world or society in which people lead wretched, dehumanized, fearful lives." The basis of all dystopian films, the purpose for which they are created, is that they are "manifestations of the 'status quo' in society being inverted" (Michael et al. 9). They explore the worst possible outcomes for society, and their central message is one of warning: that anything portrayed in a dystopian film has the potential to become reality. These films can use this "inverted status quo" to allow audiences to understand problematic features of contemporary society, and what needs to be fixed before we become a reflection of these dystopias. This is a form of social critique–the use of often exaggerated hypothetical possibilities to point out these issues. In this paper the framework of social critique is used as a fundamental principle for examining how the portrayals of family in a young adult dystopian film can affect its central message.

While feminism was not a main focus of this research, it is impossible to discuss familial structures within dystopian film in particular–not to mention Hollywood in general–without mentioning its gender roles. The term "feminist" has been loosely defined as "[understanding] the oppression of women." (Martinez 46) A feminist critical reading of young adult dystopian literature and film demonstrates a unique phenomenon: more often than not, the protagonist is a rebellious and resilient teenage girl. In other words, the complete opposite of a traditional heteronormative depiction of femininity. However, in spite of the strength and brutality these young women show, they remain fiercely loyal to their friends and are generally devoted to a loving family (see especially: Katniss Everdeen from *The Hunger Games*). On the other hand, when the protagonist is a young male, he is just as strong and witty, but he probably doesn't have a stable nuclear family unit–if a family is present, they're likely evil, or at the very least side characters with no effect on his development (see: Thomas from *The Maze Runner*). These fundamental stereotypes paint a clear picture of the gender roles of young adult protagonists within a familial structure. The baseline remains: female characters are generally loyal and family-oriented, while male characters are generally independent. Looking at whether or not a protagonist's family fits the so-called gender "norm" can reveal much about the film's message and the angle from which its social critique may be understood.

Purpose

Of course, these foundational generalizations are not all-encompassing and exceptions are seen, especially as the movement for equality and representation in film gains traction. The purpose of this paper is to investigate the patterns and deeper reasoning behind gender roles in these dystopian films with respect to familial structures, and to answer the research question: How do young adult dystopian films employ traditionally-gendered tropes regarding familial relationships to examine and critique social issues?

Methodology

To achieve the goals of this paper, I will be analyzing four young adult dystopian films released in the past decade: *The Hunger Games* (2012), *The Maze Runner* (2014), *Divergent* (2014), and *The Giver* (2014). These films have been chosen for their overall representation of contemporary young adult dystopia as a genre. They are generally well-known and well-liked by audiences. Additionally, they all achieved relative commercial and critical success and have ratings of six or more stars on IMDb. All four of these films feature teenage protagonists but include a wide spectrum of familial relationships, allowing me to examine different structures and possibilities of family within the larger scope of a society-critiquing dystopia.

The Hunger Games is based on Suzanne Collins' 2008 novel of the same name. The film is set in "Panem," a dystopian version of North America. The land has been split into twelve districts with varying degrees of wealth, all of which specialize in a different industry. Products from the districts feed into the Capitol, the wealthiest part of the empire. Each year, the Capitol hosts the Hunger Games, a heavily-televised event where two teenage "tributes" from each of the districts are chosen to fight to the death in an arena, all for the entertainment of the wealthiest citizens. The film stars Jennifer Lawrence as Katniss Everdeen, a teenage girl from District Twelve who volunteers to participate in her younger sister's place after she is chosen as tribute for their district. *The Hunger Games* is arguably the most commercially popular of the four films, grossing $152.5 million opening weekend, the third all-time most successful opening weekend at the time of its release. It holds an 84% approval rating on the movie rating website *Rotten Tomatoes*, and has been praised for its "conceptual genius," including the societal critiques that it both implicitly and explicitly portrays (Suderman).

Divergent is a film adaptation of a 2011 novel by Veronica Roth. Set in a dystopian Chicago, the city is split into five factions, all of which encompass a different value. When a child turns sixteen, they take a test determining which faction is best suited for them, and are forced to pick a faction to live out the rest of their lives in. Beatrice Prior, later known as Tris (Shailene Woodley), is a teenager who was born into the Abnegation faction. When she takes the aptitude test, she finds that she is Divergent, a highly rare type of person who has the traits of multiple factions. Tris must protect herself and her identity as Divergents are hunted and killed for being threats to the society. *Divergent* is largely a social critique about conformity, in which the faction system is used as an allegory for the modern labor market. The film opened to less critical acclaim than *The Hunger Games*, but still earned $56 million, the highest live-action debut of the year at the time of its release. Tris has also been praised as an uncommonly well-developed teenage character. As Michael O'Sullivan of the Washington Post puts it, she is "fascinating for what she does, not merely for whom she likes." Additionally, *Divergent* has been recognized for its appeal to a wider range of audiences, with fifty percent of its opening weekend audience being viewers who had not read the book prior to seeing the film.

The Giver is an adaptation of Lois Lowry' classic 1993 novel *The Giver*. Its dramatic situation is somewhat simpler, but no less horrifying. Known only as "the community," the film presents a society in which every differentiating factor has been removed–weather, intimacy, dreams, race, even color. Similar to *Divergent*, sixteen-year-olds are sorted by the governing body into different professions in which they will work for the rest of their lives. Brenton Thwaites stars as Jonas, a sixteen-year-old boy who is chosen to hold the responsibility of keeping all memory of humankind's history–unknownst to the rest of the population–inside his head. He is passed this mantle from the previous "receiver of memory," who dubs himself "The Giver." *The Giver* touches heavily on the themes of individuality, as an eerie warning of the impending future that could stem from a completely homogenous society. All citizens of "the community" are made to follow stringent rules for speech, like "precision of language," which is meant to prevent unnecessary lying. The consequences, of course, being that abstract words that aren't directly referenced in the rules–such as "love"–lose meaning and are forgotten, while words that make it into the rules–such as "apology" become meaningless from over-use. It's considered "a cautionary tale about what happens when language is controlled and limited… where citizens have no language available to them outside of 'newspeak'" (O'Malley).

The Maze Runner is an adaptation of James Dashner's bestselling novel *The Maze Runner* (2009). It details the story of Thomas (Dylan O'Brien), who wakes up with no memories and is brought to the Glade, a patchy society of teenage boys. The Glade, as Thomas later learns, is built inside of a deadly, ever-changing maze, and the "Gladers," as they call themselves, have built their community–and social hierarchy–around trying to escape it. None of the boys know why they were put there, and none of them know the way out. Each Glader has a different assigned job, and all of them work together to keep the society running. The most difficult of these jobs, that of the "runners," search the maze every day trying to find an exit. When Thomas is thrown into this situation he becomes a sort of Messiah figure: the lives of the Gladers begin to change in reaction to his presence and it becomes clear that he is willing to try harder than anyone else to escape. The film is rated 65% on Rotten Tomatoes, noted for its visual style and themes. Darren Mooney points out "a sense of enforced consensus, of dictatorships that bind societies together through well-reasoned and carefully-articulated fear-mongering." While *The Maze Runner* does not explicitly discuss the concept of family, but this is explained by the characters' memory loss; there are many moments in the film and relationships within the community which mirror those of a familial structure and imply that the community is a stand-in for the families lost.

Research Methods

To reiterate, the main goal of the study is to answer the research question: How do young adult dystopian films employ traditionally-gendered tropes regarding familial relationships to examine and critique social issues? A qualitative approach should be used to identify these tropes and analyze them accordingly. I will be using various types of film analysis in order to collect qualitative data for this study. Juan J.G. Noblejas states that there are two "operations" included in evaluating fiction: a "first perusal" comprising of "a comprehension of the surface structures of the narrative and dramatic content," and a "'second perusal or navigation" concerned rather with a hermeneutical analysis of the deep poetic structures of the text, if they exist" (2). In my analysis, I will be following this structure and watching each film twice, with each viewing focusing on different elements.

My "first perusal," focusing on the surface-level factors, will be dedicated to the general plot and inter-character relationships seen in each film. During the "second perusal" I will

observe the dialogue and visual components that make up the deeper "poetic structures" of the film. This will include use of language, as well as the structure, cinematography, and pacing of the scenes.

Observations–The Hunger Games

The Hunger Game is not explicit in its discussion or subversion of familial gender roles, but instead implies its social critique through its story. Katniss, the protagonist, is a teenage girl who lives with her single mother and younger sister in the poorest part of Panem. The film clearly establishes Katniss' familial relationships early on. The very first scene shows Katnisss comforting her sister, Prim, after she has a nightmare. As the exposition develops, we also see the tense relationship between Katniss and her mother. It's implied that this divide is caused by the absence of her father. We learn the story in a flashback scene, in which Katniss' father, recognizable from the black-and-white photo that sits on the family's mantelpiece, descends on a rickety metal elevator into an underground coal mine, which later explodes.

Katniss' mother, Mrs. Everdeen (Paula Malcomson), is heavily affected by her widowed status. She is in an almost-catatonic state–pale and virtually unresponsive when spoken to. The script describes her as "40 but looks 60, deadened by grief and fear," and her demeanor makes it clear not only that Katniss is the main provider for the family, but why. (Collins et al. 9)

Indeed, from the beginning, Katniss functions as the matriarch of the family. She tends to her younger sister and sings songs for her when she's disturbed by a nightmare. She crawls through a broken electric fence to hunt game in the forest beyond the borders of District 12, and sells her captures at the market. When Prim puts on her outfit for "The Reaping," she goes up to her mother, clearly expecting a reaction. Mrs. Everdeen says nothing so Katniss swoops in, playing the role of loving sister and telling her she looks beautiful. This scene illustrates the tension between Katniss and her mother. Katniss is frustrated that her mother isn't doing anything to help herself or Prim, but cannot say so with her sister present.

The emotional climax of Katniss' familial story occurs during "The Reaping." Katniss has spent the entirety of the previous scenes assuring Prim that her name will not be chosen to participate in the games; nevertheless, the first name to be drawn out of the bowl is Primrose Everdeen. Katniss frantically volunteers to be a tribute in place of her sister, emphasizing her loyalty and courage.

The final scene involving Katniss and her family occurs after she volunteers. When Prim and Mrs. Everdeen come to say goodbye, Katniss' first priority is Prim's well-being. She, as always, comforts Prim and reminds her of the ways they will still be able to eat and make money after Katniss is gone. On the other hand, she treats her mother more bluntly, telling her: "You can't tune out again. Not like when dad died. I won't be there anymore, you're all she has. No matter what you feel, you be there for her, do you understand?" This scene illustrates that Katniss' loyalty is not solely toward her family, but more specifically toward her sister. She is fiercely protective of Prim, and would pressure anyone to make sure she stays safe, even her own mother.

Katniss appears to subvert traditional gender roles as a teenage girl. She is strong, the primary provider in her family. She is intelligent and quick-thinking, and most of all, not defined by her relationship to a man. In fact, Katniss rejects many aspects of traditional femininity and the fate that she believes she will experience in District 12. "I'm never having kids," she remarks dryly to Gale in an early scene. She knows that not having kids is improbable, but is disgusted by the idea of raising children in a society where they will be subjected to the horrors of the Reaping.

In a different way, Katniss also embraces gender roles. While she is hard, sarcastic and indifferent at times, her emotional connection with her sister is the very core of her character. Even when she leaves her sister behind, she shows the same kindness to Rue, who parallels Prim inside the games. As Rue dies, we hear Katniss sing Rue the same song that she sang to Prim. Katniss' loyalty to her family is a crucial part of her character that both validates the traditional feminine gender roles and demonstrates another side of her personality.

Aside from Rue, another obvious parallel of Katniss' family throughout the film is that of Effie Trinket, District Twelve's flamboyant Capitol representative, to Katniss' mother. The two characters serve similar roles in Katniss' life, even though their characteristics are vastly different. Where Effie is loud, Mrs. Everdeen is quiet. Where Effie's clothing and color palette are bright, Mrs. Everdeen's are muted. However, both characters are portrayed as mother figures to Katniss and guide her in different ways. The differing representations of parallel "motherly" characters in Katniss' life is another factor in the discussion of gendered stereotypes.

In *The Hunger Games*, Katniss' emotional connection to her sister Prim contrasts with her strength and rebelliousness toward her mother and her opposition toward having children, illustrating two contrasting notions of familial gender norms.

Divergent

The discussion of familial relationships is more obvious in *Divergent*. While *The Hunger Games'* opening scene establishes Katniss as the main caretaker of the family, a wide contrast can be seen in the first scene of *Divergent*, which begins with Tris' mother, Natalie, cutting her hair. Tris goes on to introduce her family, and the further exposition scenes serve to demonstrate the loving (at least for now) nature of the Priors. The first few scenes of the film all center around their seemingly average family unit: Tris, her older brother Caleb, her mother Natalie, and her father Andrew, who works as a government official. It's clear why the two elder Priors belong in Abnegation, the faction that preaches selflessness. Tris explains that Abnegation rejects vanity, dressing plainly, eating bland food, and helping others instead of themselves. However, Tris does not belong in the faction. She explains that while "it's easy" for Caleb to help others out, it's never come naturally to herself. This is the beginning of her character arc.

The night before the "Choosing Ceremony," Caleb stops Tris in the kitchen and tells her to "think of the family but also think of [herself],"–ominous foreshadowing of his decision to move to the Erudite Faction. In that moment, Caleb conforms to the role of the protective older brother, looking out for Tris like he has done for their entire lives.

The societal ideal of "faction before blood" is emphasized in different ways throughout the film. It is first said by Jeanine, leader of the Erudite Faction, as she tells the sixteen-year-olds about their future. Loyalty to the faction is especially important, she goes on to explain before the choosing ceremony: "once the choice has been made, there will be no change permitted."

The choosing ceremony ends with the Prior family split up. Tris moves to the Dauntless Faction, Caleb changes to Erudite, and the film displays a final parting shot of Natalie's lingering stare toward her daughter as she follows Dauntless out of the auditorium. Tris' decision to change factions and leave behind her prior role as dutiful daughter is evidence of her refusal to bend to traditional gender roles. She is an objectively "rebellious" character, changing factions even though Tori, who administered her aptitude test and revealed her divergence to her, tells her to stay in Abnegation. Though her mother asserts that she will "love [her] no matter what," Tris'

actions will have consequences that test that and many other relationships. The stability of Abnegation's government is questioned after the leaders of other factions learn of the news that both of Mr. Prior's children moved to different factions.

When Tris goes to the Erudite faction to find her brother and warn him about what is happening she finds Caleb to be quite changed. He tells Tris that he believes "Erudite is right"–they should get to control the government instead of Abnegation. Caleb's betrayal from previously loyal and caring older brother, is our first clue that Tris' family, along with the society, are being torn apart. A sort of "civil" war breaks out, with Dauntless and Erudite on one side and Abnegation on the other, further dividing the family's loyalties.

While at Dauntless, Tris meets Four, a mysterious instructor. As they get closer, Tris finds out that Four is the estranged son of Marcus, an Abnegation government official like her own father. Four's subplot mimics Tris' story, though showing how the familial situation can be further complicated by the fact that Four was physically abused by Marcus before his faction change: he moved to Dauntless in order to escape his father and his troubled past. These familial divides contrast with the dramatic situation given of an inter-faction war, giving the audience an idea of how familial and societal divisions affect the younger generation coming of age.

The Giver

The Giver reflects on a truly dystopian world, in which everything is controlled to reflect the ideal–even family. In the film, "family units," as they are called, are not related by birth. Instead, infants are delivered by "birth mothers," and given to their assigned families when they have passed the "test of maturity," determined by their weight. If the infant fails the test, they are "released,"–killed through lethal injection. This institutionalized family structure creates an eerie, impersonal concept, in which family members are only bound together by law. When Jonas learns the meaning of the word "love" through his training with the Giver, he arrives back home and asks his "parents" if they love him. His mother replies that "precision of language" is important, and tells Jonas' sister that he has "used a word so antiquated that it no longer has any application." Love is not a concept in "the community," creating a feeling of indifference between parent and child.

When Jonas accepts his position of receiver, we hear of a mysterious "previous receiver" that the Giver had apparently failed at training. The Chief Elder threatens the Giver with this

unseen history, telling him, "don't fail us again." Any questions Jonas asks about the fate of the previous receiver are deflected by the Giver, all the way up until the Giver accidentally shows Jonas the memory of a battle, and he learns of the horrors of death and war for the first time. Jonas storms out of the Giver's house, and we are shown a flashback–a girl retreating down the same hallway Jonas leaves through years later. This, presumably, is the previous receiver, and when Jonas returns the next day, the Giver also reveals that he once had a family of his own; The previous receiver, Rosemary, was also his daughter, who begged to be "released" after he showed her the experience of loss. Rosemary, played by pop singer Taylor Swift in an unconvincing wig, is a clear parallel of Jonas, down to the climactic moment before he sets off on his journey in which the Giver tells Jonas that he loves him. This action contrasts the cold replies of Jonas' "parents," demonstrating a flaw of the "family unit" system–that children are only the *responsibility* of their parents and the protective bonds we associate with the concept of family no longer exist.

This concept is touched on in an early scene when the Chief Elder, the leader of the Council of Elders that runs the society, pays Jonas a visit via hologram at his "dwelling" in order to ask about the Giver's actions When Jonas ends her tense interrogation by claiming that he is late for training, the Chief Elder turns to his mother. "I'm surprised you're not more worried about him," she says. "If he were my responsibility, I would be." It's important to note that not only does the Chief Elder imply that Jonas' mother isn't doing a good enough job at keeping him in line, she also refers to Jonas as her "responsibility." Instead of saying "son," or "child," she frames the statement like Jonas is a burden, or simply a job that needs to be performed by his parents.

In *The Giver*, Jonas conforms to the gender-specific familial stereotypes of being a male character raised within a distant family.

The Maze Runner

The Maze Runner has the least direct portrayal of family--at least, by the definition of blood relations. The Gladers have been stuck inside the maze for years, and there's undoubtedly a familial order and connection between them by the time Thomas shows up. The society has been built up by order and organization, but also companionship and collaboration. In a way, the boys all depend on each other like a family. This is exemplified when Alby, their leader, pulls

Thomas aside after a few days in the Glade and tells him that "you're one of us now." The importance of family–feeling that one belongs–is not lost on the Gladers, even though they're in the worst possible situation. Newt, who is second-in-command, reveals Alby's past to Thomas: he was the first one to enter the Glade, forced to spend a month there alone as if in solitary confinement. "When those other boys started coming up one after the other," Newt says, "he learned that the most important thing is that we all have each other."

It's important to note, though, that all of the boys are amnesiac. They hold no memories of their past lives or the circumstances through which they ended up inside the maze, and this is a driving force behind their continued exploration and drive to find out what's on the other side, even after three years. Chuck, a young Glader, forms a friendship with Thomas. He confesses to Thomas that he's sure that his parents miss him, but "[he] can't miss them because [he doesn't] remember them." From then on, Chuck's parents become a symbol. The night before the Gladers attempt to make their great escape Chuck shows Thomas a hand-sculpted wooden relic, telling him to find his parents and give it to them once they get out of the maze. Instead, Thomas gives the relic back to Chuck, and says he should give it to them himself. Later in the movie, Chuck is shot by Gally, an older boy, and he gives the blood-stained relic back to Thomas, repeating his wish that his parents receive it, and know he was thinking of them.

The pressures that contemporary society can foist upon teenagers may be the biggest thematic "issue" dealt with in this film, which becomes clear at the end when it is revealed that the entire maze was an experiment put together by an organization called WCKD. Thomas and the Gladers finally escape the maze, only to find themselves in a lab, faced with a video of WCKD scientist Ava Paige (Patricia Clarkson) telling them that they have been experimented on in order to find a cure for a disease, as the young generation are the only ones who have developed immunity.

Generally, the character of Thomas in *The Maze Runner* conforms to traditional gender roles within familial structures. The film gives Thomas the most extreme version of the dystopian male protagonist's familial stereotype. He does not have a real blood family; depending only on his friends, he is made to become a strong leader under the forced environment of the maze. Even when he obtains hope (symbolized by the idol and Chuck's parents) he loses it quickly.

Analysis

The conclusions that can be drawn from my research represent a wide range of social critiques. *The Hunger Games* corresponds to expectations of women in society, *Divergent* represents divisions of family, *The Giver* indicates dangers of conformity, and *The Maze Runner* displays the exploitation of children and young adults.

Expectations Of Women

In *The Hunger Games*, Katniss' simultaneous opposition and conformity to stereotypical roles of women within familial relationships demonstrates the film's larger critiques of the expectations of women.

First, the film criticizes these expectations through Katniss' thoughts on having children, pointing out the fact that women in Panem's society are destined to grow up and reproduce so that their children can once again take part in the ritual of The Reaping. Additionally, Katniss earns a status as a multifaceted, "strong female" character who both loves her sister and despises the idea of reproduction. This shows the incredulity of the expectations put on a teenage girl. In order to succeed, Katniss needs to be powerful yet emotional, resilient yet vulnerable. She needs to provide for her family, yet also look good while doing it. Neuhaus summarizes this dilemma, saying: "In these films, it's perfectly all right, nay, imminently laudable, for women to kick ass and flex their muscles and be all empowered—as long as they are teenagers. If your boobs are still high and firm and your skin youthful and dewy, why, there's nothing more attractive than leading the rebellion or fighting your way to freedom."

The differences between the portrayals of Katniss' mother and Effie further emphasize this expectation. Mrs. Everdeen is shown in an increasingly negative, or at least ambiguous, light. She is wooden, indifferent, and does nothing for Katniss or Prim; Katniss treats her harshly whenever they interact. The film seems to be shaming her and telling viewers that she is a bad mother. On the other hand, while Effie is often reduced to a comedic side character, she's shown in a much more favorable light than Mrs. Everdeen. She has a brighter color palette and treats Katniss with much more respect than her own mother. Katniss' rejection of motherhood–as yet another expectation placed on women–paired with the bleak portrayal of Mrs. Everdeen paints the concept and station itself in a negative light.

The critique of female expectations in society is shown in *The Hunger Games* through its depictions of motherhood and Katniss' contrasting characteristics.

Societies Division

Divergent is a heavily-implied allegory for the job market. Its faction system, and the hunting-down of those who don't fit into it, criticizes the way societies try to place each person into a box based on their qualities. Additionally, the ritual of The Choosing symbolizes how difficult it is to exit that box once a decision has been made at a young age. The faction choice that Tris makes contradicts traditional gender roles and emphasizes the theme of division. While Tris believes her change is insignificant, it starts an inter-faction war, which subsequently divides her family even more.

As the separations in her family grow wider, Tris becomes more rebellious and less traditionally feminine. First, she chooses Dauntless, disconnecting herself from her parents; later, she sneaks out of her faction to visit Caleb, where she realizes that he, too, has begun to push away his past. Each time she displays an act of rebellion, the faction war escalates, paralleling her decisions. In the final act of the movie, Tris becomes a stronger heroine, actively fighting against the Erudite government to stop their mind-control of Dauntless soldiers. She briefly reunites with her parents to help fight for the lives of Abnegation, before they are both shot and killed by soldiers. This is the final nail in the coffin for Tris' familial relationships. The trend can be clearly seen: Tris breaks gender stereotypes and becomes rebellious, her family becomes more distant, and the war gets worse.

The critique of societal division is shown in *Divergent* through the failure of the faction system and, on a more personal level, the division of the Prior family. At its core, the film's message is that too much segregation can harm a society and make its members turn on one another. Tris' decisions regarding her family subvert stereotypes because she is disloyal to them. This fact is used as an emphasis to the greater storyline, demonstrating the individual consequences that could occur from a split society.

Dangers Of Conformity

The Giver's message is the polar opposite of *Divergent*'s, a warning of what the future may hold for a society marked by homogeneity. The concept of family itself in the community,

the idea of a "family unit," already fits the traditional family role of a male protagonist. The euthanization of babies who don't fit the standard and the impersonal way that infants are given to their "assigned families" naturally creates this type of family for Jonas. He is distant with his parents the entire film, and finds solace in the one person who does not blindly believe in the ideals of the community–The Giver.

When Jonas learns the meaning of the word "love" and asks his parents if they love him, they evade the question, giving impersonal answers. Conversely, when Jonas sets out on his adventure past the Boundary of Memories in order to return humankind's memories to the people living in his society, The Giver explicitly tells Jonas that he loves him. The Giver's love for Jonas is reflected in its parallel to The Giver's relationship with Rosemary, his late daughter. During the ending scene, as the Elders watch Fiona, Jacob's friend, being "released," the Giver pleads with the Chief Elder to stop hunting down Jonas and holding back the real memories. "I loved [Rosemary]," he tells the Chief Elder, who then reminds him about the need for precision of language.

"I could not be more precise," he replies.

The idea of a society that mirrors the community: colorless, emotionless, and memory-less, is a harsh exaggeration of our hypothetical future. The glaring problems and evils portrayed in the film are supported by Jonas' indifferent family, and the contrast to his relationship with the Giver. Jonas' story, and his acceptance and conformity to traditionally-gendered stereotypes about male protagonists' familial relationships.

The dangers of conformity is the social critique seen in *The Giver*, emphasized by Jonas' distant relationship with his family and the contrast of his close relationship with the Giver.

Exploitation Of Children

The Maze Runner's main theme is the exploitation of children. While the teenagers are fighting for their lives in the maze, they're in reality being watched and experimented on by WCKD scientists. This can also be seen as a critique of the pressure put on teenagers by adults; the Gladers are believed to be the only generation that holds the cure to the Flare and they're essentially told that their sacrifice is humanity's only chance at survival.

Thomas' lack of a blood family–most notably, parents–are a significant factor in his following of familial stereotypes. Unlike Chuck, Thomas does not think about his parents or

what they might represent. Instead, he becomes a stubborn natural leader, and works to find a way to exit the maze despite any possible costs or dangers. He's never overly emotional and never forms deep attachments to another character. While he is friendly with the Gladers, he is not incredibly close with any of them, at least during the timeline of the film. When Thomas realizes he was once on the other side of the experiment, it increases his distance with the other Gladers.

Chuck's death also feeds into the discussion of hope and gender stereotypes. Chuck unintentionally subverts gender stereotypes. He is a softer character, more of an introvert, and, unlike the other characters, ruminates about his parents. Even when the other boys have lost all hope, Chuck continues to hold on to the fact that he may see his birth parents. In this way, Chuck's death in the film represents the loss of innocence and distances the remaining Gladers from the idea of family. In killing Chuck, the film also kills the idea that any of the boys will be able to find their birth parents.

This extends back to the discussion of exploitation. Without parental figures to protect or aid him, Thomas' conformity to stereotypes allows the film to more clearly demonstrate the unfairness of the situation. Additionally, the increasing pressure placed on him and the other characters by external adults who are not family emphasize the dangerous potential effects of placing too much pressure on young adults. The social critique of child exploitation is depicted in *The Maze Runner*, and is supported by Thomas' conformity to male familial stereotypes and his lack of a true blood family.

Conclusion

As the voices of teenagers and younger generations become increasingly prevalent in today's society, it's important to envision their place in the future. While it may not be as immediately dramatic as the dystopias depicted in popular culture, film can still be used as a medium to observe and criticize a particular group's significance. The analysis of YA dystopian films can reveal previously unseen connections between the choices of young adults and different aspects and issues of society.

The overall goal of this study was to compare and analyze young adult dystopian films through the framework of gender and familial structures to answer the research question: How do

young adult dystopian films employ traditionally-gendered tropes within familial relationships to examine and critique social issues?

The first section of the study presents an introduction and background on the central topic. The study considers the frameworks of social critique, femininity and gender ideals, and family in order to identify the ways in which gendered tropes are used to display criticism. The second section details the methodology and research procedures used to collect data for the study. Qualitative data was collected for the study using the "first/second perusal" method, in which each viewing of the film was used to focus on different aspects of the story and visuals. The third section demonstrates the findings and results of the data collection, categorized by each film. *The Hunger Games* simultaneously subverts and affirms familial gender stereotypes, while *Divergent* opposes them and *The Giver* and *The Maze Runner* both conform to them.

Finally, the fourth section evaluates and applies the data to draw conclusions and relationships with each film's main societal criticism. The study revealed that young adult dystopian films often use traditional gender roles within familial or community relationships as extended metaphors for their social critique. More specifically, this can be seen in *The Hunger Games* through Katniss' treatment of her sister and her thoughts on motherhood, *Divergent* through the paralleled divisions of the Prior family and the faction system due to Tris' decisions, *The Giver* through Jonas' distance to his family and the homogenized society, and *The Maze Runner* through Thomas' exploitation and lack of parental figures.

In the twenty-first century, negative gender stereotypes in the media seem like a long-forgotten dream. Nevertheless, by studying young adult dystopian films, these antiquated notions of gender can still be used as an element with which to evaluate and understand a film's social criticism. YA dystopia is a genre adored and loved by more than just young adults, and the films of this genre can be judged as more than just basic dystopian movies altered to appeal to teenagers.

Works Cited

Divergent. Directed by Neil Burger, performances by Shailene Woodley, Ansel Elgort, and Theo
      James, Lionsgate, 2014.

Garcia-Noblejas, Juan Jose. "Personal Identity and Dystopian Film Worlds." *Virtual*
      Materialities, 19 May 2004,
      https://scriptor.typepad.com/bckprch/files/jjgn-dystopian_films-IAPL04.pdf.

Gilmore, Natasha. "Nielsen Summit Shows the Data Behind the Children's Book Boom."
      Publishers' Weekly, 17 Sept. 2015,
      https://www.publishersweekly.com/pw/by-topic/childrens/childrens-industry-news/article
      /68083-nielsen-summit-shows-the-data-behind-the-children-s-book-boom.html.

Hemphill, Kara E., "Gender and the Popular Heroines (and Heroes) of the Young Adult
      Dystopia" (2015). *Honors Research Projects*. 132.
      http://ideaexchange.uakron.edu/honors_research_projects/132

Martinez, Veronica Andrea, "The Female Nature: Representations Of Motherhood And Nature In
      Dystopian Films" (2019). *Open Access Theses & Dissertations*. 2874.
      https://digitalcommons.utep.edu/open_etd/2874

Michael, Bethan, et al. *There's More to Fear Than Fear Itself: Fears and Anxieties in the 21st*
      Century. Brill, 2019.

Neuhaus, Jessamyn. "On That Women like Good Movies When Women Are the Bad Guys in YA
      Dystopian Films." *Bitch Flicks*, 4 Feb. 2015,
      https://btchflcks.com/2015/02/when-women-are-the-bad-guys-in-ya-dystopian-films.html
      .

O'Malley, Sheila. "The Giver." *RogerEebert.com*, 15 Aug. 2014,
      https://www.rogerebert.com/reviews/the-giver-2014.

Schmidt, Christopher. "Why Are Dystopian Films on the Rise Again?" *JSTOR Daily*, 19 Nov.
      2014, https://daily.jstor.org/why-are-dystopian-films-on-the-rise-again/.

Suderman, Peter. "MOVIE REVIEW: 'The Hunger Games' Offers a Feast for Sci-Fi Fans." *The*
      Washington Times, The Washington Times, 21 Mar. 2012,
      https://www.washingtontimes.com/news/2012/mar/21/movie-review-the-hunger-games-o
      ffers-a-feast-for-s/.

The Giver. Directed by Phillip Noyce, performances by Brenton Thwaites, Jeff Bridges, Meryl Streep, and Taylor Swift, The Weinstein Company, 2014.

The Hunger Games. Directed by Francis Lawrence and Gary Ross, performances by Jennifer Lawrence, Willow Shields, and Paula Malcomson, Lionsgate, 2012.

The Maze Runner. Directed by Wes Ball, performances by Dylan O'Brien, Blake Cooper, and Patricia Clarkson, 20th Century Fox, 2014.

British And Zulu Perception And Representation Of The Anglo-Zulu War Of 1879
By Luke Steene

Abstract

With every historical event, there are multiple perspectives. Which person or group of people is able to publicize their perspectives more so than the others significantly influences an event's historiography as well as its popular perception. War amplifies this trend because there are winning and losing parties, in which the victor's perspective usually looms relatively larger in historical influence. As time goes on, however, historians attempt to reconcile the differences between the sides involved with a conflict, to gain a precious account of historical truth. The Anglo-Zulu War of 1879 is no exception to this trend, and this paper seeks to analyze the British and Zulu perceptions of the war and analyze the implications of their great differences and clarify historical truth by analyzing misconceptions about the war.

The Start of the War and Cetshwayo

It is clear that Britain vyed to exert their authority over Zululand for both geopolitical and economic reasons. A British South African Confederation that spanned coast to coast would provide a solid naval defense in case of an imperial war with Russia, which was presumed to be imminent due to Russia's numerous threats of invading Constantinople. Sir Bartle Frere's placement as chief commissioner to realize this vision should not be placed out of context; he had previously founded the Colonial Defense Committee that coordinated British colonial efforts in the Middle East, South Asia, and South Africa (O'Connor). In essence, the British annexation of Zululand was a facet of the "Great Game" with Russia. Britain further felt that the Cape would make an efficient and lucrative port being en route to India. Save for the prospect of trading, O'Connor contends that at the time of the war business in South Africa was scant and gold had been found in negligible quantities. The area held great amounts of diamond and cobalt, however, though these industries were disorganized and mismanaged (Cope). It is plausible that the prospect of business in the area was a stronger motive for catalyzing a conflict to subvert Zulu sovereignty than of that which actually existed in 1879.

British officials further felt that Zululand was a menace to the nearby colonies of Natal and Transvaal. The fact that *The Natal Witness* spitted regurgitations of the most aggressive British imperial policy portrays the general distaste in Natal for its Zulu neighbors. Much of this conception derives from Cetshwayo's reputation as being a belligerent tyrant, and thus he was presumed to pose a threat to the colonial order established nearby. Cetshwayo did desire to follow his uncle Shaka's footsteps and nation-build, but his representation requires some reappraisal (Masina). A.T. Cope contends that the British were misinformed as Cetshwayo would never have incited violence to the extent that his predecessors, Shaka and Dingane, did. From a Zulu perspective, held in Magema Fuze's written historiography, <u>The Black People and Whence They Came</u>, Cetshwayo was a "man of good character" and was even critical of Dingane. Cetshwayo did require young Zulu men to serve in the military for certain time periods, which British officers felt would solely be used to wage war (Cope). Really, although Cetshwayo's army was the beacon of Zululand's defense strength, it was firstly a tool for public service. Often the military would advance infrastructure in rural villages and serve as a local police force (Cope). Cetshwayo's coordinating with John Dunn to accumulate and trade arms on a coastal route exacerbated British concerns, although there is no evidence that Cetshwayo would have used these weapons to invade Zululand's neighbors (Masina).

Further, the events of the Anglo-Zulu War represent Cetshwayo's pacifistic inclinations. Isandlwana tremendously weakened the British army and after the battle it spent considerable time obtaining provisions to continue fighting. Although Natal was at his disposal to invade, R.L. Cope maintains that Cetshwayo restrained and continued to petition for peace, even though his emissaries were often met scornfully by British military officers. Cetshwayo was further willing to comply with an investigation by the Border Commission, founded by the British Colonial Office to investigate alleged Zulu border violations in Natal. It is in these ways that Cetshwayo fulfills Fuze's claim that he was "dignified" and undermines Frere's accusations that he was a "bloodthirsty, aggressive despot" (Cope).

Cetshwayo's reaction to the Border Commission underscores how he was not hostile to his British neighbors. Masina contends that Cetshwayo took up the prospect of having a British-facilitated Border Commission arbitrate the border disputes with enthusiasm. This is even as the Commission held members with anti-Zulu leanings sponsored by Theophilus Shepstone. Due to these anti-Zulu predispositions, Frere was originally set to accept the Border Commission

as a means to justify his impending invasion of Zululand, although the Commission ended up ruling in favor of the Zulu (Masina). Frere desired to use the Commission to justify the facilitation of violence against the Zulu people, rather than arbitrate disagreements, the latter being a sentiment his Zulu counterpart held. Cetshwayo had a precedent of complying with his British neighbors, too. Cetshwayo had previously allowed Shepstone to intervene in his coronation in 1873, holding it in the British-Christian style that included much pageantry ("Sir. Theophilius Shepstone").

Shepstone, a British statesman, misconstrued Cetshwayo's coronation (he did not realize that Cetshwayo previously held one in the Zulu fashion) as affirmation that the Zulu government existed at will of Britain (Deflem). This may have contributed to the misguided British view that posed Cetshwayo as extremely belligerent because it delivered the impression to British officials that if they could manipulate Cetshwayo's realm, they could do the same to his image. This perception of the coronation is at odds with how Cetshwayo perceived the event, in which he felt there was greater stability in the British-Zulu relations as a result of Shepstone's role ("Sir. Theophilius Shepstone").

These misinterpretations of King Cetshwayo were facilitated through the lens of Frere's political expediency. As Frere was appointed in South Africa to realize a British confederacy, and as Zulu sovereignty undermined this vision, Frere had to convince Parliament that foregoing war against the Zulu people was the best course of action. Frere is recorded stating that invading Zululand would relieve the Zulu people from Cetshwayo's "reign of terror" (Bowman). Parliament fed into this rhetoric, though the grounds upon which it lies are unsupported by evidence and are based on misguided preconceptions. Really, justifying the war as a means to combat authoritarianism was more expedient for Frere because it was a motive that could resonate with the emotions of the general British government and population. It put the British, or how they viewed it, on the "right" side of the moral argument. This stems from the British colonial ideology in which Britain was destined to aid what it saw as less developed countries (Anderson). However, by the war's end, Frere had instituted exactly what he said he claimed to be subverting, an imposed and forceful government. An example of the British government's authoritative tendencies in the realm is the hut tax that was imposed on African tribes in Natal and Zululand. Being taxed without representation in Parliament, the African tribal people were subject to the provisions of this antidemocratic action (Ramdhani).

Frere's reasoning for sparking conflict is unjustified and a result of misconception. After the Border Commission ruled that the Boers had violated the Zulu border in their moving within Utrecht District (Coleman and Garstang). Frere concealed the reports from the media and the British Parliament while authorizing that Lord Chelmsford move troops to Natal in preparation for the Ultimatum (Masina). Frere catalyzed violence based on an assertion of Zulu border violations, which had no viable evidence based on the Border Commission's report. A rumor later circulated that Cetshwayo was in cahoots with the rebellious Xhosa tribe to counter the British (Masina). Frere added this to his list of grievances against the Zulu, although it is unsupported by historical evidence. The spreading of this rumor and Frere's witholdance of the Border Commission's report demonstrates the great extent to which British officials would manipulate the truth to suit their political goals.

Fuze offers an explanation as to how Frere may have justified the event of Zulu encroachment upon Natal. The happenings surrounding the affairs of Sihayo's wives are, however, not specifically iterated in western literature and most academic journals pertaining to the subject, presenting a clouded perception in how different people have perceived the conditions that led to war. When Sihayo, a local chieftain, was in the capital, two of his wives committed adultery. In accordance with custom, they were killed by Sihayo's son, Mehlokazulu, in Natal, after they had fled there. Frere summoned Sihayo to appear in Natal but he did not show, maintaining innocence in the fact that the women killed were from Zululand, not Natal, and therefore the Natal government need not intervene. Fuze remarks that at that point, "it became clearly apparent that the white people were determined to wage war against the Zulus" (Fuze). Such an ordeal may have further fed into British claims of the Zulu's belligerence, although the Zulu's actions were governed by an accepted societal tradition. Zulu custom did not call for the harming of any resident of Natal, yet Fuze holds that the British government was wary of a Zulu invasion at any point (Fuze).

The Ultimatum and Peace Negotiations

As Chelmsford relocated his troops to Natal, he delivered the Ultimatum to Zulu emissaries, who then delivered its message to Cetshwayo. The most striking provision of the Ultimatum was that it demanded Cetshwayo to disband his military, which was at the forefront of British priorities. The Zulu people possessed the most potent military force among the South

African tribal nations, and thus was the most menacing to British colonial rule. The rest of the Ultimatum discerns a domino effect that would inevitably result after Cetshwayo disbanded the Zulu military. The British delegated for the placement of an "esteemed" British Resident throughout Zululand to govern indirectly, a token of the Indian Model Frere had formerly supported (Laband). Other provisions dictate that Cetshwayo would discontinue what the British perceived as unjust executions and stop the king's enforcement that young men serve in the military (Deflem). Cetshwayo's powers seemed too authoritarian, and too powerful, for the British, although they were derived from a politically legitimate government, whose ruler was checked by a counsel and held popular support. A striking story relays that for a month after the Battle of Ulundi, no Zulu person was willing to reveal to British explorers Cetshwayo's whereabouts in Ngome Forest, where he was hiding (Fuze). Cetshwayo was the dominant figure in Zululand, so in order to inject their influence in Zululand, the British felt they had to delegitimize him as monarch.

When Cetshwayo did not comply with the Ultimatum, Frere delivered orders to Chelmsford that he should cross the border with British forces, and thus was the official start of the Anglo-Zulu War (Laband). The role of the British as instigators of this conflict reveals that British officials always intended that the Ultimatum be fulfilled. It further presents one way in which the Zulu and British perspectives differed. Whereas British officials were steadfast with the Ultimatum, Zulu officials maintained that it could be softened into a more peaceful settlement, and this has to do mainly with the nature of what the Ultimatum delegated. The provisions of the Ultimatum were unfeasible for the Zulu people if they wanted to maintain their territorial sovereignty. Accepting it further contradicted Zulu morals; Cetshwayo specified that he would have rather attempted military victory against the British than surrender to the Ultimatum (Bowman). However, as military conflict is never ideal, Cetshwayo sought to use diplomacy for a peaceful settlement. He sent several emissaries to embark on a number of missions in an attempt to get Chelmsford to revoke the Ultimatum. Zulu diplomats offered gifts such as cattle in exchange for peace. However, British officers spurned these diplomats and Chlemsford issued a declaration proclaiming that he would only see a Zulu representative should they be relaying the information that Cetshwayo had decided to succumb to the full will of the Ultimatum (Laband). The British's reactions to Zulu diplomats are further a result of the British imperial mentality. As Frere and Chelmsford intended that Britain rule over Zululand, they

would not entertain Zulu peace provisions. It is the complete contrast of goals that the Zulus and British had, which originates from their relationship to the Zululand territory, that led the two parties to war over the Ultimatum.

These contrasting perceptions pertaining to how the Ultimatum should be acted on manifested within the perceptions of Zulu peace missions during the war. Messengers like Johannes, Mfunzi, and Nkisimane went on multiple occasions to British military bases to offer gifts and appeal for a peaceful end to the conflict. Cetshwayo went to the lengths to recruit Cornelius Vijn, a Dutch trader, to translate and pen responses to the British that advocated for peace (Laband). The monarch's frantic cry at Ondini, "What have I done? I just want peace," reveals most of the legitimacy of Zulu diplomatic efforts. In a final, desperate attempt he had sent cattle to the British army, though this effort was futile in halting the fighting (Masina). Nevertheless, Zulu diplomats advocated zealously for peace on behalf of Cetshwayo.

The largest barrier to Zulu peace negotiations was the British imperial mentality. As the Ultimatum and Chelmsford's invasion portray, the British always intended that Cetshwayo's sovereignty be uprooted, and thus shrugged them off as being insincere. When Johannes, Mfunzi, and Nkisimane, among other influxes of Zulu emissaries, appealed to General Crealock, they were spurned and directed to Chelmsford, who only retorted the iterations of the Ultimatum, already deemed unfeasible to the Zulu people who desired to retain their territorial right (Laband). Vijn's first letter went unanswered and Chelmsford rejected the gifts- two symbolic ivory tusks and one hundred and fifty cattle- that were delivered along with it. Chelmsford then directly repudiated Vijn's second letter (Laband). The British sentiment that Zulu peace negotiations were not genuine was ignorant to the arduous efforts Cetshwayo and his diplomats put into them. It is further a facet of the steadfastness in which the British felt they were entitled to obtain control of Zululand. It was necessary that British officers delegitimize Zulu peace negotiations to justify their continuation of the conflict to the public and Parliament and further to achieve their goal, which was to remove Cetshwayo as monarch. It should be noted of the importance of justifying the war that it was unpopular when Chelmsford delivered the Ultimatum, with many believing that its provisions were too strenuous (Anderson).

Certain facets of Zulu society did make it more susceptible to British manipulation. An example is the delegation of national and regional power. Cetshwayo was the monarch of Zululand, but his national counsel and the local governments, established by regional chieftains,

checked the power he held. In the midst of conflict, and as Chelmsford repudiated Cetshwayo's emissaries, Chelmsford reasoned with coastal chieftains, whose loyalty to Cetshwayo waned when they realized that being friendly with the British meant that they could possess their local territories post-conflict. More chieftains acted in accordance to this trend as a British victory became apparent (Anderson). Chelmsford deliberately oversaw the implementation of this type of arbitration to blindside Cetshwayo and discredit his national government, understanding that Zulu society was built on a structure where should Cetshwayo lose his base, his power would dissipate as well.

The Zulu societal hierarchy served as a hindrance to their own pursuit for peace. This is most apparent in the context of Johannes, Mfunzi, and Nkisimane's plight. After Crealock commanded that they consult Chelmsford, the diplomats traveled back to the Mbonambi homestead to heed the advice of Cetshwayo, stalling their negotiation. This was in accordance with the Zulu custom that guided Cetshwayo's public servants not to conduct any type of arbitration that was not specifically requested by the king. In this instance, to align with the hierarchy their culture delegated, Johannes, Mfunzi, and Nkisimane went to Cetshwayo before going to Chelmsford to obtain specific commands. However, Chelmsford misconstrued this delay as an instance of Zulu ingenuity in carrying out their diplomacy (Anderson). This sentiment was misguided and was a result of a cultural disconnect, and its existence hindered Zulu officials who sought to legitimize their arbitration.

Isandlwana

Isandlwana was instrumental to the war's nature and highlights the difference in British and Zulu perspectives in the context of an actual battle. Chelmsford felt that losing to an African tribe was ignominious and it also shattered all preconception that he held about an easy victory against a military that had notable technological disadvantages (Headrick). Apart from losing the majority of a two-thousand-men flank, British officials were concerned with public and Parliamentary approval back in England. The rest of the conflict would thus be a ploy to obtain approval for the war. In addition, it would provide an outlet for Chelmsford to avenge himself. As such, British military officials increased the intensity of their fight to demoralize the Zulu people in popular British perception and uplift their careers as military generals. British troops

plundering Zulu villages and utilizing more tortuous methods on Zulu prisoners demonstrates this trend (Lieven).

There are two ways in which the British officials manipulated Isandlwana to mitigate criticism- through media depiction and in their testimony in front of the Court of Inquiry. The media brought forth lots of imagery that displayed seemingly gallant British soldiers being slain ruthlessly by seemingly barbaric Zulu soldiers wearing little clothing and bearing exaggerated facial features, while the British bravely defended their fort (Anderson). These images were heavily biased in favor of a British perspective which sought to pit the Zulu as an outlandish enemy to elicit adverse public reaction toward the Zulu people and invoke a sense of British patriotism in a way that called for revenge against them. It was in this way that public support could be on the side of those generals who had failed at Isandlwana.

Perhaps the most striking story of British manipulation of the media is in the story of how Melvill and Coghill saved the Queen's colors. According to the legend that circulated in British popular thought, Generals Melvill and Coghill escaped Isandlwana in pursuit of saving the flag bearing the Queen's colors for their regiment. However, once they had crossed the Mzinyathi River, they were killed by native forces (Lieven). As a token to their supposed heroism, the two received Victoria Crosses postmortem (Hicks). Such a glamorous story invoked British patriotism and directed attention away from the blunders of Isandlwana, but the heroism of Melvill and Coghill must be reappraised, especially of the latter.

Hicks asserts that Coghill had decided before the battle even started that he would retreat, an assertion made based on his pessimistic diary entries. This was not out of line with the character he portrayed, either. Testimonies express that Coghill had detested the duties that regimental life entailed. Further, the horse that Coghill was riding was not even his own; he had left in the utmost haste and very early on in the battle. There is a greater case in favor of General Melvill, however. During the battle, he had been loyally at the side of General Pulleine, so he may have left the camp with the Queen's colors under Pulleine's orders, although there is no evidence that actually supports this. At the Mzinyathi River, where he met, by chance, General Coghill, wind currents caused the flag to fly out of his hands and into the water. As Melvill waded in the water to search for the colors, he became a victim of a Zulu surprise attack (Hicks). The complex story and circumstances of Melvill and Coghill's plight differ from its romantic depiction in British media. Its implanting in the media as such, however, was deliberate and

effective in taking the pressure off of Chelmsford and mitigating the embarrassment of Isandlwana. It hence served a practical purpose.

Perhaps foreseeing an investigation into Isandlwana, Lock contends that Chelmsford initiated a Court of Inquiry to investigate Isandlwana to influence its findings and deflect blame for the mishap on to other British officials. The most viable scapegoat was Colonel Durnford because he was killed during the battle and thus could not defend himself in front of the Court. Chelmsford maintained that Durnford had not followed Colonel Crealock's orders to specifically take command of Isandlwana in its defense before the run-in that sparked the battle. Crealock backed up this testimony in front of the Court, but witheld his notebook that contained documentation of the days leading up to Isandlwana under the excuse that it had just been recovered by an exploration team and was stained with mud. Crealock's unwillingness to hand over this crucial piece of evidence indicates that its contents may have contradicted his verbal testimony- that his orders to Durnford were more vague than what he described. This evidence demonstrates that Crealock and Chelmsford did skew Durnford's role in Isandlwana in order to safeguard their own reputations.

In part, Chelmsford's own complacency cost the British Isandlwana, although this is not the narrative the Court of Inquiry received. An example is how Chelmsford rejected the advice of Boer officials to organize a laager formation in the encampment (Hicks). The actual need for laagers is contested. The Court reasoned that the establishment of a laager formation would not have changed the outcome of the war, though this conclusion was based largely on the biased reports of Chelmsford. Others, like General Pulleine and Captain W.H. Stafford, did believe that laagers were necessary in the battle. Further, Chelmsford had overestimated the reports of his scouts, like Dartnell, and had not taken Fannin's accurate report as to where the Zulu military was located in the area (Hicks). This evidence suggests that Chelmsford misjudged, and in some cases, was negligent to the concerns of the British military, which resulted from his sureness of a timely and obvious victory against the Zulu. The Court did not reveal Chelmsford's mistakes, though it did, misguidedly, focus on Durnford. Chelmsford and Crealock's manipulation of the Court to suit their own benefices sheds light on the extent to which British military officials sought to safeguard their reputations, even if their accounts strayed from the truth.

In Fuze's account, the British chose Isandlwana because it was in close proximity to where Sihayo had resided, reiterating that in the Zulu perspective, the affair of Sihayo's wives

was a key instigator of the war. Fuze further specifies that the British were the clear aggressors of the situation, having fired first at a nearby Zulu encampment. His accusations should be taken with some caution, being that his work possesses Zulu bias to some degree, but they do serve to clarify how Isandlwana was actually started. British accounts are more vague and attribute the battle to an accidental encounter (Laband).

Whereas popular British media was filled with romantic depictions of Isandlwana, little of the sort exists in Zulu literature. Fuze credits the Zulu army with moving toward the British "with great speed" and for "killing and destroying the European army that was there." Despite sharing his nationality with the victors, Fuze's depiction is not embellished, which reveals that the battle had a more minimal effect on the Zulu national conscious than it did for the British. It should be noted that Fuze's report on Zulu history is one of the only Zulu-produced histiographies on the subject, so there is a small source list in which historians can actually gauge Zulu perspectives on the war. This is attributed to the Zulu custom of retelling history orally rather than by written text ("Oral Histories"). Nevertheless, there is no evidence that Isandlwana elicited great patriotism from the Zulu people.

For Fuze, however, Isandlwana was of greater significance than the war's other battles. In his account, it occupied one page, while the latter occupied just one half that. This may be attributed to how the Zulus found themselves on the winning side of Isandlwana, but not at the war's conclusion, so this observation may denote perception differences based on preferential biases or, and much more viable considering the war's overall insignificance in Fuze's account (it only occupied 6 pages out of 128 pages in the book that spanned a time frame of about two hundred years), that the entirety of the war was far less significant to the Zulu than to the British. In summary, there are striking differences as to how the Zulu and British people perceived Isandlwana and how they portrayed it.

Rorke's Drift

Rorke's Drift avenged the British army after Isandlwana and raised public morale for the war. A highly outnumbered British flank overwhelmingly winning against a larger Zulu army was helpful propaganda for the Colonial Office to promote Britain's foreign policy in South Africa (Sharrett). In part, this fixation on Rorke's Drift was to distract from the British failure at Isandlwana, and the effects of this were lasting as Rorke's Drift inspired many works. At the

time, cartoons exalted the British victory. A notable example is Harry Payne's depiction of Private Williams Jones defending the hospital unit by fighting off Zulu soldiers with a spear. Payne portrays other British soldiers helping walk off the injured as some of Zulu soldiers lie on the ground outside the hospital door (Link). The drawing is not overly embellished, though it does glorify the British's role in Rorke's Drift, a tactic used for political gain to bolster support for colonial policies.

The most prominent creative art stemming from Rorke's Drift is Cy Endfield and Stanley Baker's film, *Zulu*, released in 1964 (Sharrett). Directed from the British perspective, its popularity well throughout the 20th century demonstrates how England's imperial narrative remained relevant even as more of the Queen's colonies gained independence. In part, this exposes nostalgia for the days of British imperialism as England's worldly domination tempered, and most importantly, testifies to the relative importance of British imperial missions to British culture. Baker and Stanley recruited the Zulu king Buthelezi to portray Cetshwayo while hiring thousands of Zulu extras. The movie and its implications seem to be less significant to Buthelezi, who laughed at battle scenes Baker showed him for inspiration. When the king inquired about Rorke's Drift, he was not aware of it, meaning that it was not so momentous in Zulu culture as to warrant enduring relevance (Sharrett).

The film's content further poses certain implications about the historiography of British colonialism and the events of the Anglo-Zulu War (in this case, Rorke's Drift) in popular media. Sharrett first analyzes how specific aspects of the film positively display the Zulu. In the hospital, a Swiss guard comments on the bravery of the Zulu soldiers.This represents a shift in perception. In the late 1800s, British media had often emphasized that the Zulu were more formidable competitors only when compared to other African tribes (Anderson). In *Zulu*, it seems that this notion stands, though on an individual basis specific to the Zulu, which dignifies the Zulu comparatively more. However, these depictions have ulterior motives, which Sharrett feels may pertain to the motive of uplifting the British military and making its feat much more heroic in the audience's perception. It should be noted that Rorke's Drift was a proud moment in British military history due to how much the British flank was outnumbered. However, their technological advantage should not be understated, and knowledge of it creates certain reservations as to just how much of an upset the battle really was.

Sharrett asserts that much more evidence supports the film's blatant characterization of the Zulu as an "Other," primarily on racial grounds. This may pertain less to the thought systems of the 1960s, when the film was created, but more to those of the 1870s during the war itself. Nevertheless, it demonstrates how an imperialist perception of the war penetrated into more modern media. Sharrett describes in detail how Stanley and Cynfield ignore that the Zulu army was split into organized legions by belittling their battle tactics to prancing, running aimlessly, and being run over by cattle. Further, the depiction of a Zulu wedding in the beginning of the film violated social norms addressing nudity in the film, with Zulu individuals being exposed. These pictures do not stray incredibly far from what conventional Zulu dress looked like, and Cynfield and Stanley portray the British sentiment that held of the Zulu's "exoticness" in emphasizing these attributes. It should be noted that this originated from British fascination with what the British population perceived as the primitive lifestyle of African nations, though this dehumanized the Zulu people and was ignorant to the actual complexities of Zulu society ("Punch Cartoons"). Nevertheless, with real actors behind the camera, these film tactics seem dehumanizing and may imply different moral standards for the movie's actors, projected on racial lines.

Sharrett's investigation into *Zulu* sufficiently examines how Cynfield and Stanley portray Rorke's Drift, which almost mirrors the British perspective of 1879. It further underscores the continuation of misperceptions the British held of the Zulu nation in South Africa. Had Cynfield and Stanley wanted to present the Zulu in a more dignified manner, they could have depicted Cetshwayo's intricate diplomacy efforts, and had they wanted to deliver a more balanced perspective, they could have shown how British officers treated those diplomats. For the most part, *Zulu* advances a demeaning narrative of the Zulu people that the realities of the Anglo-Zulu War of 1879 do not support, and it demonstrates how the British perception of the Zulu people and the war have strayed from historical fact, even into the 20th century.

Societal Basis for the War's Representation

The social structures of British Victorian society were the basis that shaped British perceptions during the Anglo-Zulu War. These social structures- like military culture and race- did not only formulate perceptions in 1879; *Zulu* demonstrates how they have penetrated the media long after the war in its representation. Modern literature looks more different, as

historians are trying more so to balance the British and Zulu perspectives of the war (Dhlomo). Nevertheless, a rigorous analysis of these social structures helps to provide an origin for how the British perceived the war.

The British military culture was one of great competition but one that was accompanied with great social reward should one climb the ranks. Those who were given titled positions held viable careers with great political power. From this, they could profit socially and financially. As the media depicted those who served as "heroes," the role of the military as a vessel towards obtaining a prominent social standard augmented. Further, Victoria Crosses presented another tangible incentive to military officers, and they were used numerous times throughout the Anglo-Zulu War; examples include Melvill and Coghill's Crosses as well as the eleven that were awarded to those who were at Rorke's Drift (Lieven).

Due to the high-stakes nature of the British military, high-ranking officials were under immense pressure to conform to the mythologized "hero" (Lieven). Such a driving force may be why Chelmsford was so keen on influencing the Court of Inquiry, pitting Durnford as a scapegoat, and why Crealock withheld his notebook. In this way did the prominent military culture contribute to an actual misrepresentation of the history at Isandlwana. It further influenced British media depictions in a way that strayed from the war's realities. By sketching the Zulu military formations as chaotic when contrasted to the British's, even as the evidence shows that the Zulu military was split in organized legions, political cartoonists contributed to the narrative of British moral and military superiority that was catalyzed by a military structure that sponsored this view of its members.

Part of the reason why the Anglo-Zulu War and the achievements of the Zulu armed forces were not as prominent in Zulu culture was due to its more subdued military culture. To serve in the military was a more normalized activity that all men did to complete public service in the name of the monarch (Cope). The military's actions were not romanticized, hence Fuze's blanketed statements of Isandlwana and Rorke's Drift. This is not to say that the public did not hold a high regard for the military as it often served as a local police force that participated in public service projects (Cope). However, the military did not sponsor an elitist culture where top generals reaped substantial social benefits. As such, the incentive to embellish military accomplishment, distribute awards, or diminish the feats of the other side was not present for the Zulu.

As aforementioned, a Zulu approach to the retelling of the Anglo-Zulu War is found in a limited number of written sources due to the prominence of oral history in Zulu culture. As such, this analysis is limited to the extent of the available literature. However, these claims pertaining to the nature of Zulu sources on the Anglo-Zulu War maintain standing because there is little evidence that the war evoked much patriotism in the Zulu population. Additionally, after the war, most Zulu went back to living in their local realms under the same tract of land. Although infrastructure may have been destroyed, most Zulu went back to their pre-war lifestyles in due time. This means that the extent to which the Anglo-Zulu War actually changed the lives of most Zulu people was minimal, underscoring how it did not play as great of a role in the Zulu national conscious, even if Cetshwayo's government was dismantled (Anderson).

Race further contributed to British perception of the Anglo-Zulu War of 1879. The basis for this is derived from how Britain justified colonialism through the lens of race, though its assumptions were based on incorrect information. Ethnologist Robert Knox argued that race was formed during the embryonic process and that those who were most developed belonged to the Anglo-Saxon race. This made out people of color to be more childlike, and theoretically in need of an elder to aid them in running their societies, hence British colonialism (Bowman). Such ideas and rhetoric belittled the Zulu tribe in British perception. Frere once referred to the Zulu nation as being a part of "ignorant, barbaric, and childlike" African nations (Anderson). Infographics further diminished the complexities of Zulu society by crafting visions of them as savages who flailed around during battle, almost akin to children per Knox's assertions.

These types of opinions of black people led to British misconceptions about their military's superiority, hence Chelmsford's complacency before Isandlwana. When the Zulu army beat the British at Isandlwana, it was unfathomable to British militants that their army could be beaten at the hands of a black one; this idea originated from these racial perceptions that dictated black people's inferiorness to white people. Race was a driving force that caused the British to skew certain aspects of the war's retelling to establish their superiority over the Zulu people, who were ultimately harmed more by the greater waging of war.

The Zulu were race-conscious, though their perceptions of it were more egalitarian, so there was no pretense of superiority based on a biological metric. Fuze admits that he knows not of the origin of black people, and understands that colonialism established a racial hierarchy, specifically relating white people to goats and black people to sheep (think the saying, "black

sheep") to underscore how the social structures of the Western World turned people like the Zulu into outcasts, even in their own land. However, Fuze also maintains an evolutionary view of race in which all humans evolved from primates, though they may look different from one another due to genetic variation. Further, Cetshwayo remarked that "Zulus would not run away from white men," demonstrating more so how the enemy lines of the war were largely based on race (Anderson). Still, there is no pretense of Zulu literature or sentiments establishing a racial superiority, or any superiority based on biographical metrics, so race was not a societal factor that drove skewed representations of the war's events for the Zulu, like it was for the British.

Conclusion

As with all historical events, there are multiple perspectives. This is true for the Anglo-Zulu War of 1879. Whereas Britain utilized the war to promote imperial rhetoric pertaining to its perceived military superiority and the heroism of its members, the war held a significantly lower position in the Zulu national conscious. There are societal factors that catalyzed how the two perceived the war, such as race and their respective military cultures. As Britain was more focused on proving its superiority over the Zulu people and annexing Zululand, it skewed certain events, such as Isandlwana, Melvill/Coghill legend, and Cetshwayo's diplomacy efforts, to suit this agenda. This type of representation penetrated into the 20th century with *Zulu*, although more historians are attempting to bridge the gap between the two perspectives in order to obtain historical truth. Fuze's novella on Zulu history is especially valuable for this because it is one of the only authentic Zulu sources on the subject. Ultimately, the British and Zulu perspectives differed greatly, though appraising how the British and Zulu depicted each other and the war's events clarifies the realities of the Anglo-Zulu War of 1879.

Works Cited

ANDERSON, CATHERINE E. "Red Coats and Black Shields: Race and Masculinity in British
      Representations of the Anglo-Zulu War." *Critical Survey*, vol. 20, no. 3, 2008, pp. 6–28.
      JSTOR, http://www.jstor.org/stable/41556281.

Bowman, Joye. "Reconstructing the Past Using the British Parliamentary Papers: The
      Anglo-Zulu War of 1879." *History in Africa*, vol. 31, 2004, pp. 117–32. *JSTOR*,
      http://www.jstor.org/stable/4128521. Accessed 18 Apr. 2023.

Coleman, Anthony D., and Michael Garstang. "The Utrecht District and the Disputed
      Territory—a Cause of the Anglo-Zulu War Re-Examined." *Advances in Historical*
      Studies, vol. 03, no. 03, 2014, pp. 170–181., https://doi.org/10.4236/ahs.2014.33015.

COPE, A. T. "THE ZULU WAR IN ZULU PERSPECTIVE." *Theoria: A Journal of Social and*
      Political Theory, no. 56, 1981, pp. 41–50. *JSTOR*, http://www.jstor.org/stable/41801671.

Cope, R. L. "Written in Characters of Blood? The Reign of King Cetshwayo Ka Mpande
      1872-9." *The Journal of African History*, vol. 36, no. 2, 1995, pp. 247–69. *JSTOR*,
      http://www.jstor.org/stable/182312.

Cope , Richard Lidbrook. "The Origins of the Anglo-Zulu War of 1879." *University of*
      Witwatersand, 1995, pp. 1–323.

Deflem, Mathieu. "Warfare, Political Leadership, and State Formation: The Case of the Zulu
      Kingdom, 1808-1879." *Ethnology*, vol. 38, no. 4, 1999, pp. 371–91. *JSTOR*,
      https://doi.org/10.2307/3773913.

Dhlomo, Oscar D. Review of *The Anglo-Zulu War of 1879- An Evaluative Review* , Review of
      Reality (Vol. 11 No. 1) SA History ,
      https://www.sahistory.org.za/sites/default/files/archive-files2/remar79.12.pdf.

Fuze, Magema Magwaza. *The Black People and Whence They Came* . Translated by Anthony
      Trevor Cope , University of Natal Press , 1979,
      https://archive.org/details/blackpeoplewhenc0000fuze.

Headrick, Daniel R. "The Tools of Imperialism: Technology and the Expansion of European
      Colonial Empires in the Nineteenth Century." *The Journal of Modern History*, vol. 51,
      no. 2, 1979, pp. 231–63. *JSTOR*, http://www.jstor.org/stable/1879216.

Hicks, Jonathan Phillip. *"A Solemn Mockery": The Anglo-Zulu War of 1879: The Myth and the*
      Reality. Fielding Publishing, 2006.

LABAND, J. P. C. "HUMBUGGING THE GENERAL? King Cetshwayo's Peace Overtures
    During the Anglo-Zulu War." *Theoria: A Journal of Social and Political Theory*, no. 67,
    1986, pp. 1–20. *JSTOR*, http://www.jstor.org/stable/41803788. Accessed 18 Apr. 2023.

Lieven, Michael. "Heroism, Heroics and the Making of Heroes: The Anglo-Zulu War of 1879."
    Albion: A Quarterly Journal Concerned with British Studies, vol. 30, no. 3, 1998, pp.
    419–38. *JSTOR*, https://doi.org/10.2307/4053287. Accessed 18 Apr. 2023.

Link, Donald. "Bold Stand at Rorke's Drift." *Warfare History Network*, 15 July 2022,
    https://warfarehistorynetwork.com/article/bold-stand-at-rorkes-drift/.

Lock , Ron. *Zulu Victory: the Epic of Isandlwana and* . London: Greenhill Books, 2002.

Masina, Edward Muntu. "Zulu Perceptions and Reactions to the British Occupation of Land in
    Natal Colony and Zululand, 1850-1887: A Recapitulation Based on Surviving Written
    and Oral Sources." *University of Zululand* , 2006, pp. 1–354. *Yumpu* ,
    https://www.yumpu.com/en/document/read/13885708/zulu-perceptions-and-reactions-to-
    me-british-.

O'Connor, Damian P. "Imperial Strategy and the Anglo–Zulu War of 1879." *The Historian*, vol.
    68, no. 2, 2006, pp. 285–304. *JSTOR*, http://www.jstor.org/stable/24453317. Accessed 18
    Apr. 2023.

"Oral Histories and Archiving Memories in South Africa." *Oral Histories and Archiving
    Memories in South Africa | Archive & Public Culture*,
    http://www.apc.uct.ac.za/apc/projects/archival_platform/oral-histories-and-archiving-me
    mories-south-africa.

Punch Cartoons: Elizabeth Hires, http://projects.vassar.edu/punch/hires1.html.

Ramdhani, Narissa. "Taxation without Representation: The Hut Tax System in Colonial Natal
    1849–1898." *Journal of Natal and Zulu History*, vol. 9, no. 1, 1986, pp. 12–25.,
    https://doi.org/10.1080/02590123.1986.11964243.

"Sir. Theophilus Shepstone." *Sir. Theophilus Shepstone | South African History Online*,
    https://www.sahistory.org.za/people/sir-theophilus-shepstone.

Sharrett, Christopher. "OR THE LIMITS OF LIBERALISM." *Cinéaste*, vol. 25, no. 4, 2000, pp.
    28–33. *JSTOR*, http://www.jstor.org/stable/41689287. Accessed 18 Apr. 2023.

It's My Constitutional Right! Claudette Colvin's Unorthodox Plight By Cameron Sadr

"When it comes to injustice... You can't sugarcoat it. You just have to take a stand and say, 'this is not right.'"[2] - Claudette Colvin

Sometimes history tends to exclude pivotal figures who have changed the way modern society runs. For Claudette Colvin, this was certainly the case. Nine months before Rosa Parks reinvented modern expectations when she kept her seat, Colvin had done just the same.[3] However, due to her life circumstances, her name was forgotten. Throughout her lifetime, Claudette Colvin had to experience injustice, inequality, and bias. So many of these emotions were flowing through a young Colvin's mind on March 2nd, 1955.[4] The strong-willed Colvin was irritated by her rights being stripped from her because everything around her needed to be "separate but equal" due to a court case, *Plessy v. Ferguson*.[5] She wanted to take an emphatic stand for her cause. Aged 15, Claudette Colvin sat down on a segregated bus in Montgomery, staring out the window, oblivious to what would soon happen to her.[6] A white woman forced Colvin from her seat. "I felt like Sojourner Truth was pushing down on one shoulder and Harriet Tubman was pushing down on the other—saying, 'Sit down girl!' I was glued to my seat."[7] Passion, perseverance, and the tradition of her ancestors kept Colvin glued to her seat. She was dragged out of the bus, she was kicked, and she was abused. However, on that dreary day in Alabama, Claudette Colvin lit a spark of hope and revolution in many other African-Americans living in Montgomery. Although she did not know it at the time, Colvin had undoubtedly broken through history's impassable barrier, for she quietly led the way for many other famous Montgomery bus boycott activists and helped win a pivotal lawsuit.[8]

---

[2] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.

[3] Adler, Margot, and Phillip Hoose. "Before Rosa Parks, There Was Claudette Colvin." *NPR*, NPR, 15 Mar. 2009, www.npr.org/2009/03/15/101719889/before-rosa-parks-there-was-claudette-colvin

[4] Ibid.

[5] Supreme Court Of The United States. U.S. Reports: Plessy v. Ferguson, 163 U.S. 537. 1895. Periodical. Retrieved from the Library of Congress, <www.loc.gov/item/usrep163537/>.

[6] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.

[7] Colvin, Claudette, and Amy Goodman. "Democracy Now Interview with Claudette Colvin." 29 Mar. 2013, Accessed 19 Jan. 2020.

[8] Barnes, Brooks. "From Footnote to Fame in Civil Rights History." *The New York Times*, The New York Times, 26 Nov. 2009, www.nytimes.com/2009/11/26/books/26colvin.html.

"I swear to the Lord, I still can't see why Democracy means everybody but me."[9]

- Langston Hughes

During Claudette Colvin's time, Black Codes and Jim Crow laws were established because whites were afraid to lose their jobs to African Americans.[10] Segregation was the norm in the southeastern states and permitted in some of the midwestern states of the United States of America.[11] The Black Codes were set in place to control the lives of newly freed slaves.[12] Even though these African American slaves were freed, the Black Codes stated that they would not be equal to whites in America.[13] The codes limited their income and job opportunities, which created another barrier between the two races.[14] As blacks in southern Alabama stated, "Jim Crow controlled your life from womb to tomb."[15] These laws also started the idea of white supremacy.[16] In Montgomery, Alabama, the city ordinance stated that all public works would be separated, from buses to movie theaters, following the means of Plessy v. Ferguson, which stated public utilities should be 'separate but equal.'[17]

Colvin's plight began the first time she remembered leaving her house. She visited a local doctor's office where she was not allowed to sit in a chair that white patients would soon be sitting in. She felt enraged because the color of her skin forced her natural rights to get stripped from her. Another horrible event took place in Colvin's young life when one of her close companions, Jeremiah Reeves, was convicted of raping a white housewife even though he was innocent. This action made Claudette Colvin realize what was happening around her. "Jeremiah Reeves's arrest was the turning point of my life. That was when I… really started thinking about prejudice and racism."[18] Colvin understood that if this tragedy was burdening one African American's life, it must be happening all over the world. After learning about Sojourner Truth

---

[9] Hughes, Langston. *Jim Crow's Last Stand*. Literary Licensing, 1943.
[10] CRF Editing Staff. "A Brief History of Jim Crow." *Constitutional Rights Foundation*, 2013, www.crf-usa.org/black-history-month/a-brief-history-of-jim-crow.
[11] See Appendix A
[12] History.com Editors. "Civil Rights Movement." *History.com*, A&E Television Networks, 27 Oct. 2009, www.history.com/topics/black-history/civil-rights-movement.
[13] CRF Editing Staff. "A Brief History of Jim Crow." *Constitutional Rights Foundation*, 2013, www.crf-usa.org/black-history-month/a-brief-history-of-jim-crow.
[14] History.com Editors. "Civil Rights Movement." *History.com*, A&E Television Networks, 27 Oct. 2009, www.history.com/topics/black-history/civil-rights-movement.
[15] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
[16] CRF Editing Staff. "A Brief History of Jim Crow." *Constitutional Rights Foundation*, 2013, www.crf-usa.org/black-history-month/a-brief-history-of-jim-crow.
[17] Supreme Court Of The United States. U.S. Reports: Plessy v. Ferguson, 163 U.S. 537. 1895. Periodical. Retrieved from the Library of Congress, <www.loc.gov/item/usrep163537/>.
[18] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.

and Harriet Tubman from her teacher, Jo Ann Robinson, and future key organizer of the Montgomery bus boycott,[19] Claudette Colvin knew she had to make the difference her whole community was relying on, as Truth and Tubman did for theirs.[20]

"I knew then and I know now, when it comes to justice, there is no easy way to get it."[21]

- Claudette Colvin

On March 2, 1955, what would be a routine day in Montgomery, Alabama, Claudette Colvin was oblivious to what would happen in the coming hours. What happened to Jeremiah Reeves caused Colvin to be furious about racial injustices and prejudice. Also, during February, her teacher, Ms. Geraldine Nesbitt, had immersed Claudette Colvin in Negro History, with lengthy discussions about injustices black people faced across America and people who had taken a stand.[22] She taught her about the Constitution and her rights. Most importantly, Ms. Nesbitt taught Colvin to channel her anger into action. Colvin recalls, "I was tired of hoping for justice. When my moment came, I was ready."[23] That day, March 2nd, 1955, Claudette Colvin got on the Highland Gardens Bus after school and sat in a window seat on the left side joined by three other black students, one next to her and two across the aisle in the same row.[24] The bus filled up quickly, and Colvin noticed a white woman standing in the aisle next to her seat. The bus driver looked up and asked the four black girls, including Colvin, to give up their seats. As her three friends vacated their seats, Claudette Colvin did not budge. She recounted that "rebellion was on my mind that day… I hadn't planned it out, but my decision was built on a lifetime of nasty experiences."[25] The bus was filled with uproar and anger, but Colvin stood her ground. After several stops, local policemen dragged Claudette Colvin off of the bus, with Colvin yelling, "It's my Constitutional right."[26] Claudette Colvin was arrested. Claudette Colvin had started a movement.

---

[19] Robinson, Jo Ann Gibson. *The Montgomery Bus Boycott and the Women Who Started It*
The Memoir of Jo Ann Gibson Robinson. Univ. of Tennessee Press, 2011.
[20] Colvin, Claudette, and Amy Goodman. "Democracy Now Interview with Claudette Colvin." 29 Mar. 2013, Accessed 19 Jan. 2020.
[21] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014
[22] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
[23] Ibid.
[24] Hendrickson, Paul. "THE LADIES BEFORE ROSA." *The Washington Post*, WP Company, 12 Apr. 1998, www.washingtonpost.com/archive/lifestyle/1998/04/12/the-ladies-before-rosa/469bf82c-16c0-45c5-9991-812ac6a6005f/.
[25] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
[26] Adler, Margot, and Phillip Hoose. "Before Rosa Parks, There Was Claudette Colvin." *NPR*, NPR, 15 Mar. 2009, www.npr.org/2009/03/15/101719889/before-rosa-parks-there-was-claudette-colvin.

"You can't separate peace from freedom because no one can be at peace unless he has his freedom."[27] - Malcolm X

Claudette Colvin pleaded 'not guilty' to breaking the segregation laws. She was the first to deny breaking these laws in a bus arrest. Her family hired a lawyer and her case was set for March 18, 1955. She was found guilty of all three charges, "disorderly conduct, assault and battery against Patrolman Thomas J. Ward, and violation of Chapter 6, Section 11 of the Montgomery City Codes[28] which makes it 'unlawful for any passenger to refuse or fail to take a seat among those assigned to the race to which he belongs.'"[29] The rebellion had begun. On April 29th, a 36-year-old African American woman by the name of Aurelia Browder, also educated by Jo Ann Robinson, was seized for not giving up her seat to a white man and white lady. Similarly, on October 21, 1955, another black teenage girl by the name of Mary Louise Smith, followed Colvin's lead on a city bus and was taken into custody. Later that same year, on December 2nd, 1955, another black woman was arrested and imprisoned for the same reason. This black woman was Rosa Parks, a hero of the Civil Rights Movement. "Claudette had lit the fuse to a powder keg of protest, but her rebellion had caught black Montgomery by surprise. Now, nine months later, Rosa Parks was embraced by a community ready for action. Claudette had given them time to prepare."[30] African-American activists urged every black civilian in Montgomery to avoid the use of the buses on December 5th, 1955, to protest Rosa Parks's arrest and trial. 40,000 African Americans, 90% of Montgomery's population, peacefully boycotted the operation of buses throughout the city.[31] This was later known as the Montgomery bus boycott. "The Montgomery bus boycott of December 5, 1955, is widely accepted as the constitutive event of the mass mobilization phase in the modern U.S. Civil Rights Movement."[32] The Montgomery bus boycott forced revenue of transportation throughout the city to drop to record lows.[33] The city transportation could not go on without sufficient revenues. "The boycott took place from

---

[27] Breitman, George and Malcolm X *MALCOLM X SPEAKS*. GROVE Press, 1965.

[28] Montgomery, Alabama, *Code of the City of Montgomery, Alabama*. Charlottesville: Michie City Publishing Co., 1952. Alabama Department of Archives and History, Montgomery, Alabama Congress.

[29] Azbell, Joe. "5 Negroes Attack Segregation Laws in Federal Court." *The Montgomery Advertiser*, February 2, 1956

[30] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.

[31] Study.com Editors. "Impact of the Montgomery Bus Boycott" *Study.com*. 2012. study.com/academy/lesson/impact-of-the-montgomery-bus-boycott.html.

[32] Shultziner, Doron. "THE SOCIAL-PSYCHOLOGICAL ORIGINS OF THE MONTGOMERY BUS BOYCOTT: SOCIAL INTERACTION AND HUMILIATION IN THE EMERGENCE OF SOCIAL MOVEMENTS *." (2013).

[33] See Appendix B

December 5, 1955, to December 20, 1956, and is regarded as the first large-scale U.S. demonstration against segregation."[34] Whites in Montgomery were infuriated because the buses kept disappearing around the city; one by one, until there were few operating buses left in the city.[35] For the first time since the Civil War, the blacks and whites of the southern United States agreed on a statement: something in Montgomery, Alabama, needed to change.

"Free at last, Free at last, Thank God almighty we are free at last."[36]

\- Dr. Martin Luther King Jr.

On June 5th, 1956, change was on everyone's mind throughout the city. With the aftermath of the Montgomery bus boycott, the blacks simply wanted racial equality, but the whites wanted ongoing segregation and the return of the city buses and transportation.[37] The day finally came when Colvin had to testify in the crucial court case *Browder v. Gayle* challenging bus segregation laws. Colvin was nervous yet exhilarated. Exhilarated to represent the pride and tradition of her community. Exhilarated to stand for the cause that she had created. When her moment came, Claudette Colvin was the most pivotal witness of the case.[38] Crowds of people eulogized her for her sense of being wise beyond her years and showing such confidence as a young adult.[39] In one of the most pivotal trials for the Civil Rights Movement,[40] Colvin did not crack under immense pressure.[41] Fred Gray, the prosecuting attorney, stated that Ms. Colvin was a crucial witness and the case would have been lost without her.[42] Despite all odds stacked against them, the four African-American women who testified in *Browder v. Gayle*, Aurelia S. Browder, Susie McDonald, Claudette Colvin, and Mary Louise Smith, won the turning-point case of the Civil Rights Movement and broke the color barrier forever.[43] "The Montgomery federal court ruled that any law requiring racially segregated seating on buses violated the 14th Amendment to the U.S. Constitution. That amendment, adopted in 1868 following the U.S. Civil

---

[34] History.com Editors. "Civil Rights Movement." *History.com*, A&E Television Networks, 27 Oct. 2009, www.history.com/topics/black-history/civil-rights-movement.
[35] See Appendix C
[36] King, Martin L., Jr. "I Have a Dream." Speech. Lincoln Memorial, Washington, D. C. 28 Aug. 1963. A
[37] See Appendix C
[38] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
[39] See Appendix D
[40] Capek, Michael. *Civil Rights Movement*. ABDO Publishing Company, 2014.
[41] See Appendix D
[42] Fred Gray, Lecture: Bus Ride to Justice: A Conversation with Fred Gray (with Introduction by Jonathan L. Entin), 64 Case W. Res. L. Rev. 733 (2014) Available at: https://scholarlycommons.law.case.edu/caselrev/vol64/iss3/4
[43] Supreme Court of the United States. *Browder vs. Gayle, 352 U.S. 903*. 13 Nov. 1956.

War, guarantees all citizens—regardless of race—equal rights and equal protection under state and federal laws."[44] In Justice John Marshall Harlan's eyes, "Our Constitution is color-blind, and neither knows nor tolerates classes among citizens. In respect of civil rights, all citizens are equal before the law,"[45] which assisted in the final ruling of this case.[46]

"If there is no struggle, there is no progress."[47]

- Frederick Douglass

Although buses were integrated, the short term consequences of the court ruling were devastating. Whites across the city were infuriated.[48] Many African Americans received death threats, churches were bombed and destroyed, innocent victims were beaten in the streets. Anyone who had played a role in the Montgomery bus boycott was in danger. Although segregation on buses had ended, racial prejudice had not. Dr. Martin Luther King's role in society became increasingly important. As leader of the Montgomery Improvement Association during the Montgomery bus boycott, Dr. Martin Luther King became a prominent figure in society after the arrest of Claudette Colvin. "Black leaders, among them Dr. King, jumped at the opportunity to use her case to fight segregation laws in court"[49] and "the attempt to obtain justice for Claudette Colvin marked Dr. King's political debut."[50] As the new pastor of the Dexter Avenue Baptist Church, he attended mass meetings and "urged boycotters to refrain from violence and seek charity toward whites in their hearts...he talked about the power of love to change the world."[51] His charisma and passion made him a national figure in the Civil Rights Movement. He worked tirelessly to end segregation in the South and helped found the Southern Christian Leadership Conference (SCLC) which was instrumental in this cause.

Following in the path of *Browder v. Gayle,* many cases and acts were established to terminate segregation. "The Civil Rights Act of 1964, which ended segregation in public places and banned employment discrimination on the basis of race, color, religion, sex or national

---

[44] *U.S. Constitution.* Amend. XIV, § 1.
[45] Bill of Rights Institute Editing Staff. "Currently Reading: The Civil Rights Movement." *Bill of Rights Institute*, www.docsoffreedom.org/student/readings/the-civil-rights-movement.
[46] Ibid.
[47] Douglass, Frederick. "West India Emancipation." 3 August 1857, Canadaigua, New York
[48] See Appendix E
[49] Barnes, Brooks. "From Footnote to Fame in Civil Rights History." *The New York Times*, The New York Times, 26 Nov. 2009, www.nytimes.com/2009/11/26/books/26colvin.html.
[50] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
[51] Ibid.

origin, is considered one of the crowning legislative achievements of the civil rights."[52] This prominent act demolished what was left of the color barrier and marked the ending of the Civil Rights Movement.

"Success is to be measured not so much by the position that one has reached in life as by the obstacles which he has overcome while trying to succeed."[53]

- Booker T. Washington

Equality in the United States of America today is unparalleled by any nation in the world. The rights of minorities, including African-Americans, are protected by the nation's Constitution. "After centuries of exclusion, black Americans have been almost wholly accepted into the public sphere of American life, and they are central to the nation's definition of itself as a political and social community… Today we find racial equality in its political, civic, and cultural forms at a level that far exceeds any other advanced society, or even any of the large plural societies of the developing world."[54] Although discrimination is still present today, America is a complete contrast to what it was 60 years ago from a racial standpoint. Integrating whites and blacks have given society a chance to see life from a different perspective.[55] If Claudette Colvin had never sat down on that Montgomery bus on March 2, 1955, the thoughts, actions, and words of American citizens certainly would not be the same. If Claudette Colvin did not stand up for her rights, America would be robbed of possible gems in our society. Her actions broke barriers and created momentum for Rosa Parks to follow.[56] Although Colvin has been forgotten in the books of history, her courage altered the course of civilization.

---

[52] History.com Editors. "Civil Rights Act of 1964." *History.com*, A&E Television Networks, 4 Jan. 2010, www.history.com/topics/black-history/civil-rights-act.
[53] Washington, Booker T., 1856-1915. *Up From Slavery : an Autobiography.* Garden City, N.Y. :Doubleday, 1963.
[54] Patterson, Orlando. "Equality." *Democracy: A Journal of Ideas*, no. 11, 2009.
[55] Ibid.
[56] Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice.* Farrar Straus Giroux, 2014.

Works Cited

Azbell, Joe. "5 Negroes Attack Segregation Laws in Federal Court." *The Montgomery Advertiser*, February 2, 1956

    This newspaper article was essential in discovering the way in which the press thought about the ruling of the court case. It shows the thoughts of every citizen in America at the time of the arrest. It helped simplify the topic because it showed what the normal civilian was thinking, feeling, and saying during the protest.This piece of evidence was perfect for the aftermath of the event itself.

Breitman, George and Malcolm X. *MALCOLM X SPEAKS*. GROVE Press, 1965.

    This book highlights the best quotes from Malcolm X, an African-American leader. He was pivotal in winning rights for blacks. It gave outstanding quotes that were perfect to prove the fight that African-Americans fought during the Civil Rights Movement.

City of Montgomery Police Department. *Arrest Report of Claudette Colvin*. City of Montgomery, 1955, pp. 1–3, *Arrest Report of Claudette Colvin*.

    This arrest report was necessary to identify descriptions of Claudette and help show what the police department thought of her. The source also gave details about specific features of Claudette Colvin's arrest, which were necessary for proving the unfairness at the time. This shows that Claudette had courage and hope throughout the time of her arrest. This report also portrays Claudette Colvin as an antagonist "assaulting the policemen," instead of just struggling with them.

Colvin, Claudette, and Amy Goodman. "Democracy Now Interview with Claudette Colvin." 29 Mar. 2013, Accessed 19 Jan. 2020.

    This interview described the emotions racing through Claudette Colvin's mind on March 2, 1955. She dove deeper into the specific thoughts in her head. This interview had many quotes which were pivotal in recognizing her struggle. It evaluated the historical background, the event itself, and the short and long-term effects that came out of the event.

Douglass, Frederick. "West India Emancipation." 3 August 1857, Canadaigua, New York

    This speech delivered by Frederick Douglass was not during the Montgomery bus boycott or the Civil Rights Movement, but it gave impactful quotes that helped the

aftermath of the *Browder v. Gayle* court case. It helps express to the reader that if one
does not struggle, no progress will be made.

Fred Gray, Lecture: Bus Ride to Justice: A Conversation with Fred Gray (with Introduction by
Jonathan L. Entin), 64 Case W. Res. L. Rev. 733 (2014) Available at:
https://scholarlycommons.law.case.edu/caselrev/vol64/iss3/4
This interview with Fred Gray uncovers why Claudette Colvin was the star witness of
Browder v. Gayle. It also describes the life and mission of Fred Gray, the plaintiff
attorney of the case. It gave an interesting perspective from the view of the lawyer,
bringing details that were not touched anywhere else.

Hughes, Langston. *Jim Crow's Last Stand*. Literary Licensing, 1943.
This book by Langston Hughes includes his poems on his rights before the Civil Rights
Movement. From this book, the reader notices that African-Americans had little rights in
the south. Hughes' quotes were necessary in proving the rights for African-Americans
before Colvin.

Ingram, Bob. "Supreme Court Outlaws Bus Segregation." *The Montgomery Advertiser* Nov.
1956
This article gave a different perspective on the ruling of bus segregation. It was
interesting to see an opposing view. In this case, many predicted there would be mass
killings after the ruling. It displays both the joy and opposition of the court ruling. This is
incorporated into the "aftermath" of Claudette Colvin's journey.

King, Martin L., Jr. "I Have a Dream." Speech. Lincoln Memorial, Washington, D. C. 28 Aug.
1963. A
This famous speech changed the thoughts of Americans forever. Although he never lived
to see the fulfillment of his dream, he was one of the most pivotal figures in making his
dream come true. This speech helped in creating the aftermath of the Civil Rights
Movement.

Lock, Herb. "'Tote Dat Barge! Lift' That Boycott! Ride Dat Bus!"." *Library of Congress*, 1956,
www.loc.gov/exhibits/herblocks-history/fruits.html.
This political cartoon shows both perspectives during the Montgomery Bus Boycott. It
shows the resilient African Americans, and the Montgomery Bus owners who are getting

negatively affected by the boycott. This shows the value behind the protest that Claudette
ignited. This source exemplifies the short-term effects of the topic.

Montgomery, Alabama, *Code of the City of Montgomery, Alabama*. Charlottesville: Michie City
Publishing Co., 1952. Alabama Department of Archives and History, Montgomery,
Alabama Congress.

This city ordinance is the law that created the segregation barrier on buses in
Montgomery, Alabama. The city code proves that Montgomery's buses were made
"separate but equal" which made the barrier harder to overcome. This piece of evidence
gives necessary information for the historical background of Claudette Colvin's event.

Robinson, Jo Ann Gibson. *The Montgomery Bus Boycott and the Women Who Started It*
The Memoir of Jo Ann Gibson Robinson. Univ. of Tennessee Press, 2011.

This book was necessary to understand the thoughts of the brave women who started the
Montgomery Bus Boycott. It was narrated in first person, making it easy to understand Jo
Ann and Colvin's hardships and burdens throughout their lives. She explains what key
factors motivated her protest. This is used to show how Claudette was struggling in her
past situation. It then moves on to describe the major events leading up to the pivotal
court case.

U.S. Constitution. Amend. XIV, § 1. 9 July. 1868

This amendment of the Constitution states that all people, regardless of religion,
background, or ethnicity, are citizens of the United States of America. This Amendment
helped prove *Browder v. Gayle,* in the fact that segregation on buses is unconstitutional.
This helps the ruling of the court case, *Browder v. Gayle*.

Valentine, Harold. *The First Day of Integrated Bus Service in Montgomery*. *The Associated
Press*. 1956.

This photo shows the relief of African-Americans, as they are finally able to sit in in
equal seating as whites in Montgomery. It also shows the disgust of the caucasian person,
proving the aftermath of the event. This photo proved the aftermath of the *Browder v.
Gayle* hearing.

The Visibility Project. *Claudette Colvin, Aged 13, in 1953*. Montgomery, Alabama, 20 Apr.
1953.

This photograph depicts Claudette Colvin two years before her arrest. It helps create a mental image of what Claudette looked like at the time. She looks young and naive, not as if she would break a barrier in the coming years. This picture changes the common perspective of Colvin during the time of her arrest.

Warren, Earl, and the Supreme Court of the United States. *Browder vs. Gayle, 352 U.S. 903*. 13 Nov. 1956.

This court case was pivotal in the Montgomery Bus Boycott. It gives insightful details on why the case was ruled unconstitutional and recognized Claudette Colvin as a key plaintiff in this court case. This information was necessary in proving the thesis. The judges also give key insight on the court case, which gives background information that is not covered by the media. This source reveals a deeper understanding of the short and long-term effects.

Warren, Earl, and Supreme Court Of The United States. U.S. Reports: Brown v. Board of Education, 347 U.S. 483. 1953. Periodical. Retrieved from the Library of Congress, <www.loc.gov/item/usrep347483/>.

This court case was the predecessor for Browder v. Gayle. This case, which occurred during the time of Claudette's movement, was essential for segregation in Montgomery Buses to be proved unconstitutional. This source gives essential information for the historical background for many other court cases during the Civil Rights Act.

Warren, Earl, Supreme Court Of The United States. U.S. Reports: Plessy v. Ferguson, 163 U.S. 537. 1895. Periodical. Retrieved from the Library of Congress, <www.loc.gov/item/usrep163537/>.

This was the original court case that started the "separate but equal" law. This case led the way for many other city ordinances, such as the Montgomery City Ordinance of 1952, which began the segregation of buses in Montgomery, Alabama. This case was essential in proving the historical background of the Civil Rights Act.

Washington, Booker T., 1856-1915. *Up From Slavery : an Autobiography.* Garden City, N.Y. :Doubleday, 1963.

This book is an autobiography of Booker T. Washington, an African-American leader during the abolitioning of slavery. This book provided quotes about life before the Jim

Crow laws. It also provided details about the slavery in America before the Black Codes were established.

Secondary Sources

Adler, Margot, and Phillip Hoose. "Before Rosa Parks, There Was Claudette Colvin." *NPR*, NPR, 15 Mar. 2009, www.npr.org/2009/03/15/101719889/before-rosa-parks-there-was-claudette-colvin. This website article summarized the modern life of Claudette Colvin. It proves that even after she led the Civil Rights Movement, Colvin does not receive much attention for leading a revolution. This piece of evidence insists the fact that Claudette led the way for others in a quiet manner, which still impacted the Montgomery Bus Boycott.

Barnes, Brooks. "From Footnote to Fame in Civil Rights History." *The New York Times*, The New York Times, 26 Nov. 2009, www.nytimes.com/2009/11/26/books/26colvin.html. This website article gave a modern perspective on the events that happened in 1950. It summarized the Civil Rights Act, and how Claudette Colvin was incorporated into the movement. It cements Colvin as a "silent" hero of the Civil Rights Act and the Montgomery Bus Boycott. This source identifies many aspects of the aftermath of Claudette Colvin's journey.

Bill of Rights Institute Editing Staff. "Currently Reading: The Civil Rights Movement." *Bill of Rights Institute*, www.docsoffreedom.org/student/readings/the-civil-rights-movement. This article supplied a map of the U.S. that was necessary for creating an appendix. It exhibited a picture of where segregation laws were required in the U.S., and one of them was Colvin's home state, Alabama. It also listed numerous background facts on the Civil Rights Movement and it was geared towards students. It simplified the movement so it was easier to understand.

Capek, Michael. *Civil Rights Movement*. ABDO Publishing Company, 2014. This book gave a 'big picture' view on the Civil Rights Movement. It showed what effect the Montgomery bus boycott had on it and what happened after it. It also listed the lasting effects of the Civil Rights Movement from a recent perspective, as it was published in 2014.

CRF Editing Staff. "A Brief History of Jim Crow." *Constitutional Rights Foundation*, 2013,

www.crf-usa.org/black-history-month/a-brief-history-of-jim-crow.

This website provides information on the Jim Crow laws and Black Codes in southern

Alabama during Colvin's time. This perfectly exhibits the historical context in southern

Alabama. It proves how the Jim Crow laws were implemented in everyday life. This was

useful for various quotes in the historical context.

CRF Editing Staff. "The Civil Rights Act of 1964." *Constitutional Rights Foundation*,

www.crf-usa.org/black-history-month/the-civil-rights-act-of-1964.

This website article simplified the Civil Rights Act of 1964. It was made easy for school

students to understand. It revealed why the Civil Rights Act was important back then, and

why it is even more important now, in everyday life. This article also included why the

bill was initially signed.

Ennels, Jerome. *Hold Back the Night: The Legal Lynching of Jeremiah Reeves*. Independent

Publishing Platform, 2018.

This book summarized Claudette Colvin's ongoing struggle with her beloved classmate,

Jeremiah Reeves. It portrays the struggles of African-Americans in the south in the

1950s. This secondary source helped prove the historical background of the struggle of

Claudette Colvin. This book revealed why the lynching of Jeremiah Reeves was so

upsetting.

Hendrickson, Paul. "THE LADIES BEFORE ROSA." *The Washington Post*, WP Company, 12

Apr. 1998,

www.washingtonpost.com/archive/lifestyle/1998/04/12/the-ladies-before-rosa/469bf8

2c-16c0-45c5-9991-812ac6a6005f/.

This newspaper article gave details on the event itself. It named what the weather

conditions were, what the name of the bus was, and other details necessary that prove the

event itself. This article was incorporated into the event itself and the details of it. It also

proved the direct aftermath of the event.

History.com Editors. "Civil Rights Act of 1964." *History.com*, A&E Television Networks, 4 Jan.

2010, www.history.com/topics/black-history/civil-rights-act.

This article made the Civil Rights Act easier to understand. It also gave information why it was signed. This source also provided facts on the uproar that was caused after this act was signed. It helps one form the opinion that in the publishing of this act, a lot went on behind the scenes. It gave important quotes for the long-term effects.

History.com Editors. "Civil Rights Movement." *History.com*, A&E Television Networks, 27 Oct. 2009, www.history.com/topics/black-history/civil-rights-movement.
This website article exhibits necessary information on the historical context and aftermath of the Civil Rights Movement. It also gives a fresh perspective on the Civil Rights Movement, with views from historians. It also gives vital information on the key roles in the steps toward the Civil Rights Act. This article also gave insight on the Jim Crow Laws.

Hay, Jeff. *The Montgomery Bus Boycott*. Greenhaven Press, 2012.
This book highlighted the entirety of the Montgomery bus boycott, beginning with Claudette Colvin and ending with the buses being integrated. This book gave insight on other key figures in the Montgomery bus boycott. It also explained how all of these figures got together and assembled the master plan.

Hoose, Phillip M. *Claudette Colvin: Twice Toward Justice*. Farrar Straus Giroux, 2014.
This book highlighted the most important parts of Claudette Colvin's life. It helped show the historical context of Claudette Colvin's life, the unfairness she was shown, and how she struggled. It also had key interviews with Ms. Colvin along the way, giving insight on the background, the event itself, the movement she created; and the aftermath. This was the most important book for the project. It gave ideal quotes to fit each part of the paper. Throughout this project, this was the most used source.

Patterson, Orlando. "Equality." *Democracy: A Journal of Ideas*, no. 11, 2009.
This journal gave useful insight on equality everyday in America. It uses factual evidence to prove what changed since 1950, and why America is so forward because of it. This proves that Claudette Colvin's protest changed the way America would run itself forever. This source suggested ideas that are ideal for the long-term impact of Colvin's movement.

Puckett, Dan J. "Montgomery Bus Boycott." *American History*, ABC-CLIO, 2020, americanhistory.abc-clio.com/Search/Display/252779. Accessed 21 Jan. 2020.

This website article gave useful information on Claudette Colvin's plight itself. It dove deeper into the situation, the arrest, and the celebrations Claudette Colvin was involved in afterward. This document is perfect to prove that Claudette Colvin shows persistence in her struggle to break down the barrier.

Shultziner, Doron THE SOCIAL-PSYCHOLOGICAL ORIGINS OF THE MONTGOMERY BUS BOYCOTT: SOCIAL INTERACTION AND HUMILIATION IN THE EMERGENCE OF SOCIAL MOVEMENTS
This graph shows the financial impact of Colvin's stand. After her protest, the revenue of buses in Montgomery decreased dramatically. This piece of data is important to proving that Colvin truly made a change. It shows that Claudette Colvin's movement truly did make an impact on the city of Montgomery.

Smuskiewicz, A. J. "Claudette Colvin." *American History*, ABC-CLIO, 2020, americanhistory.abc-clio.com/Search/Display/1991411. Accessed 21 Jan. 2020.
This website article goes in depth behind the quote Colvin screamed as she was taken off the bus, "It's my Constitutional right!" It helps the reader understand Claudette Colvin's purpose and self-defense during her plight. This article helps prove the fact that Colvin, young but wise, was willing to use her natural rights as protection. It describes the event and the passion Claudette Colvin had as she fought for freedom.

Study.com Editors. "Impact of the Montgomery Bus Boycott" *Study.com*. 2012. study.com/academy/lesson/impact-of-the-montgomery-bus-boycott.html.
This website supplied data on the Montgomery bus boycott. The data was necessary to prove that many African-Americans joined the Montgomery bus boycott. It also revealed the lasting effects the boycott has in society, and it applies the effect to everyday life, which was ideal for the long-term impact.

A Derivation of the Surface Area of Solids of Revolution Using Real Analysis By Aditi Gargeshwari

Abstract

Surfaces of revolution form upon the rotation of a particular two-dimensional figure on the Cartesian plane around a line. Riveting intricacies stem from these three-dimensional figures, and this report, utilizing principles from several areas of mathematics, presents a proof to answer the following question: how can the formula for the surface area of solids of revolution be derived using the rigor of real analysis and foundational theorems in calculus?

Proof

Allow $f(x)$ to be a continuous function along an interval $[a, b]$, for which a and b are real numbers and for which $f'(x)$ is continuous.
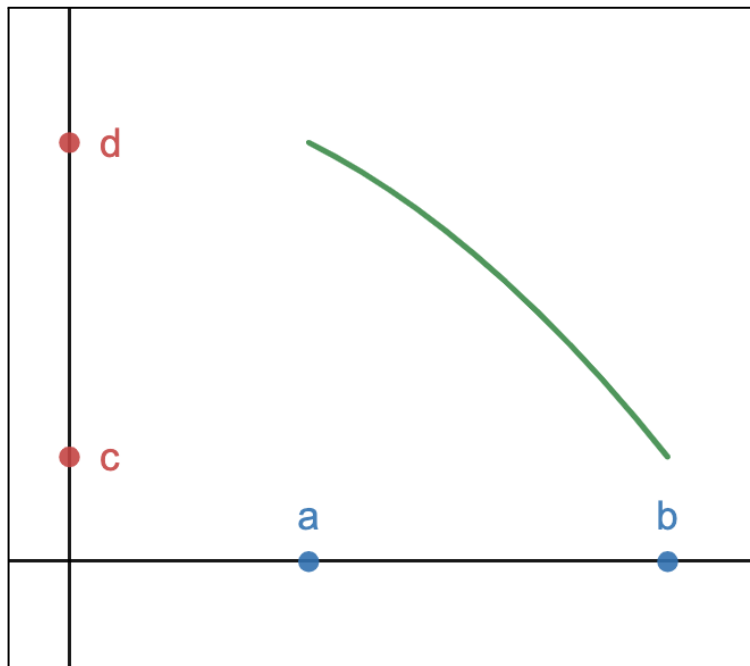
Figure 1. $f(x)$ along $[a, b]$

Revolving this portion of $f(x)$ about $y = 0$ forms a surface of revolution, as shown below.
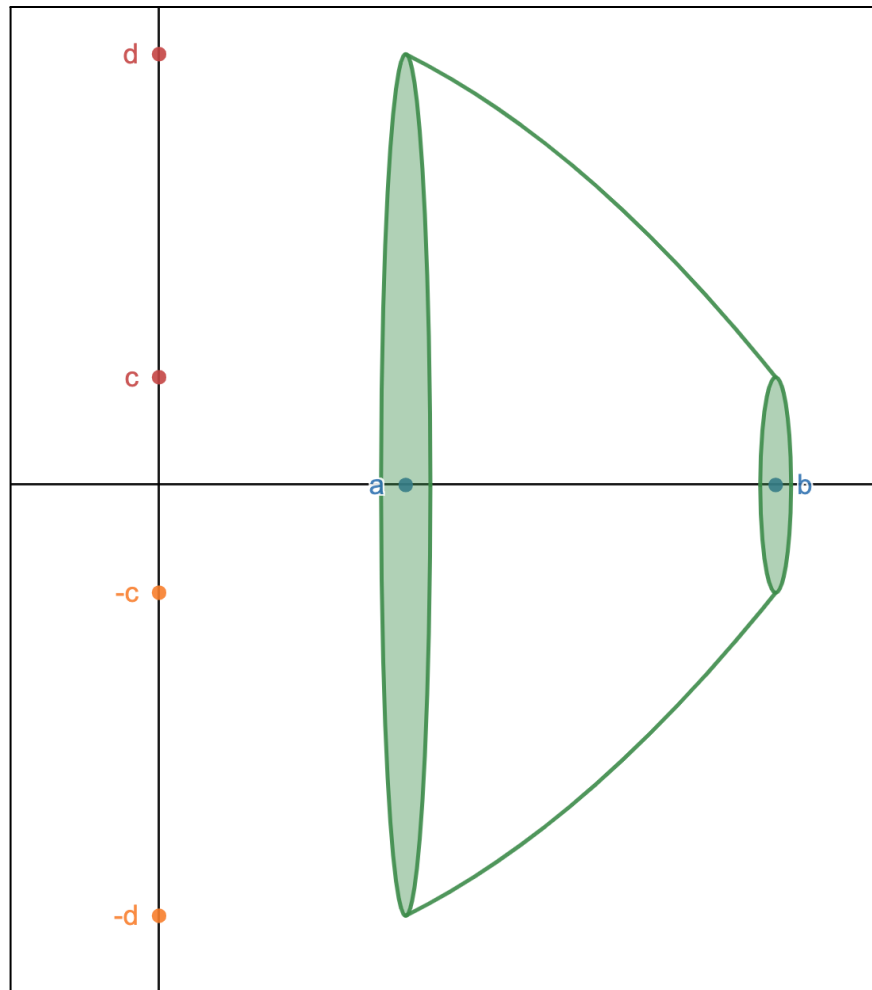
Figure 2. $f(x)$ on $[a, b]$ revolved about $y = 0$

Returning to the given graph of $f(x)$, the interval $[a, b]$ can be partitioned into n intervals of equal length. We can approximate the graph of f on the given interval by forming n line segments, all of whose y-values are function values at the endpoints of each interval. Subsequently, we can revolve this collection of segments along $[a, b]$ about $y = 0$. For instance, dividing $[a, b]$ into 3 partitions ($n = 3$) results in the following solid:
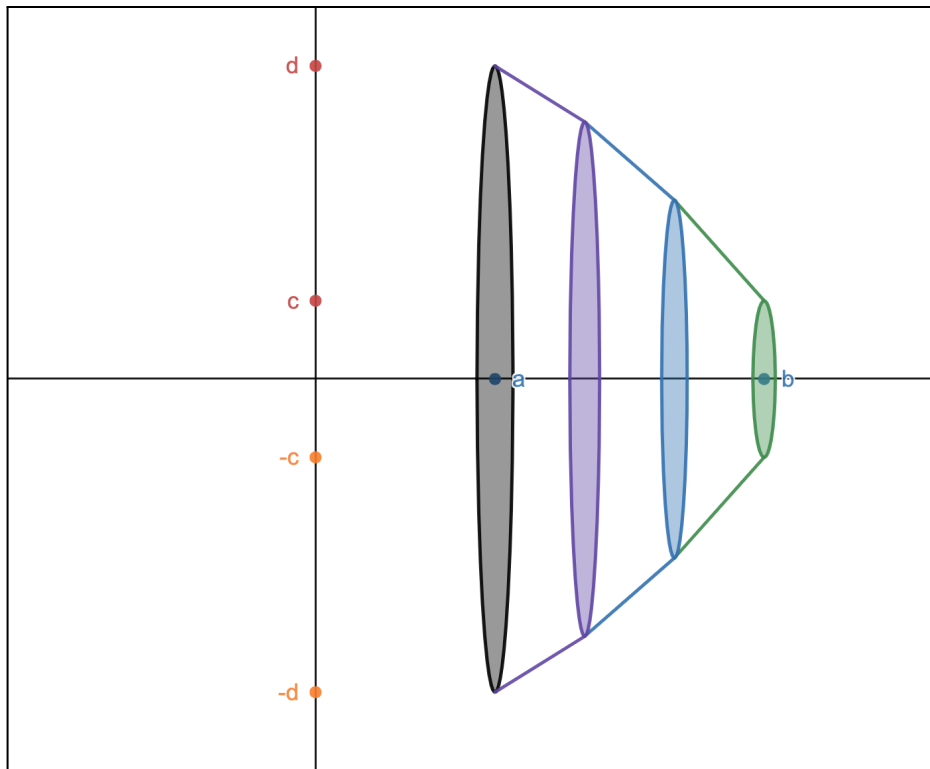
Figure 3. Segmented approximations of $f(x)$ revolved about $x = 0$

The new solid is composed of n frustums. A frustum is the product of the revolution of a right trapezoid about the leg perpendicular to both bases. The following figure illustrates a frustum:
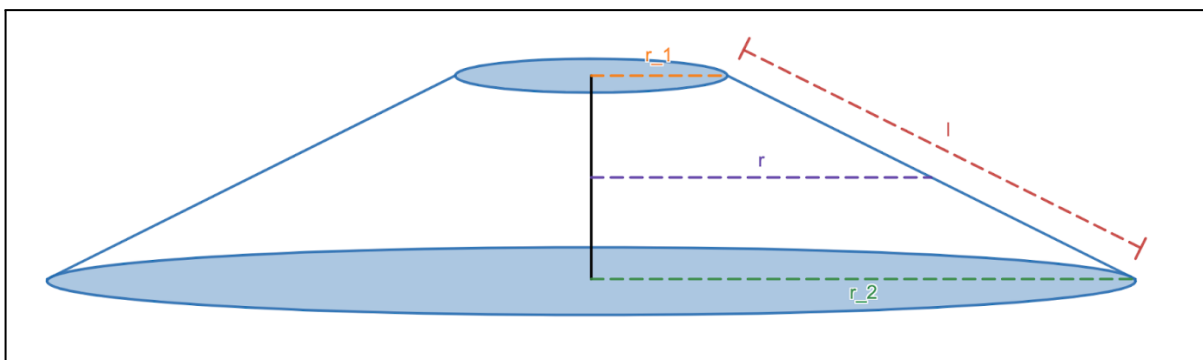

Figure 4. General Frustum

The *lateral* surface area of a frustum is defined as:

$$A = 2\pi r l$$

where: $r = \frac{1}{2}(r_1 + r_2)$; r_1 is the smaller radius, r_2 is the larger radius, and l is the slant height of the frustum.

In the context of the given function f, along *one* of the partitioned intervals $[x_{i-1}, x_i]$:

- r represents the average of $f(x_{i-1})$ and $f(x_i)$.
- l represents the length of the segment connecting the points $(x_{i-1}, f(x_{i-1}))$ and $(x_i, f(x_i))$.

Utilizing the formula $A = 2\pi r l$, and replacing each quantity with its equivalent value in terms of the function f, the lateral surface area of one frustum along $[x_{i-1}, x_i]$ can be defined as:

$$A_i = 2\pi \left(\frac{f(x_{i-1}) + f(x_i)}{2}\right) |L_{i-1} L_i|$$

... where $|L_{i-1} L_i|$ represents the length of the segment connecting the function values at the endpoints of the interval $[x_{i-1}, x_i]$.

We will now focus *only* on $[x_{i-1}, x_i]$.

The Mean Value Theorem can give us a value $x = x_i^*$, at which the function's instantaneous rate of change is equal to the average rate of change along the interval. In other words, $x = x_i^*$ will satisfy:

$$f'(x_i^*) = \frac{f(x_i) - f(x_{i-1})}{x_i - x_{i-1}}.$$

This instantaneous rate of change is derived from a small right triangle formed within $[x_{i-1}, x_i]$ by a nearly linear hypotenuse (lying on the graph of $f(x)$), an adjacent leg formed by the "run", and an opposite leg formed by the "rise". Hence, the *length* of the hypotenuse of this triangle (and therefore the length of the function's curve on this interval) can be approximated as:

$$L = \sqrt{1 + (f'(x_i^*))^2}.$$

Additionally, the Intermediate Value Theorem can give us a value $x = x_i^{**}$ at which the function value is the average of the function values at the endpoints. In other words, as the number of partitions n becomes infinitely large, the size of each interval $[x_{i-1}, x_i]$ becomes arbitrarily small. Under this refinement, the value $x = x_i^{**} \in [x_{i-1}, x_i]$ given by the IVT (satisfying the condition $f(x_{i-1}) < f(x_i^{**}) < f(x_i)$) can be said to essentially lie at the center of the function values at the endpoints:

$$f(x_i^{**}) \approx \frac{f(x_{i-1}) + f(x_i)}{2}.$$

Using the values provided by the Mean and Intermediate Value Theorems, A_i can be represented with the expression:

$$A_i = 2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2}.$$

Subsequently, the *total* volume of the solid composed of frustums can be represented as:

$$\lim_{n \to \infty} \sum_{i=1}^{n} [2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} \, \Delta x].$$

Upon the refinement of the interval $[a, b]$, every subinterval $[x_{i-1}, x_i]$ becomes arbitrarily small. As a result, every pair of values x_i^* and x_i^{**} grows arbitrarily close. Moreover, it has been

established that $\Delta x = \frac{b-a}{n}$, so refining $[a, b]$ increases the number of partitions n. We must refine enough to keep $\Delta x < 1$ so that, for some arbitrary $\epsilon > 0$, the following statement holds true:

$$\Delta x \mid \sum_{i=1}^{n} (2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} - \sum_{i=1}^{n} (2\pi f(x) \sqrt{1 + (f'(x))^2}) \mid < \epsilon.$$

Following refinement, the above expression representing A_i can then be written as:

$$A_i = \lim_{n \to \infty} \sum_{i=1}^{n} [2\pi f(x_i) \sqrt{1 + (f'(x_i))^2} \Delta x].$$

The above sum is a composition of continuous functions; hence, it is Riemann-integrable. We are now trying to demonstrate the following:

$$\lim_{n \to \infty} \sum_{i=1}^{n} 2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} \Delta x = \lim_{n \to \infty} \sum_{i=1}^{n} 2\pi f(\kappa) \sqrt{1 + (f'(\kappa))^2} \Delta x.$$

… where $\kappa = \inf_{x \in [x_{i-1}, x_i]} f(x)$ and $\Delta x = \frac{b-a}{n}$.

This is equivalent to showing that the following series converges to $L = 0$:

$$\sum_{i=1}^{n} ((2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} \Delta x) - (2\pi f(\kappa) \sqrt{1 + (f'(\kappa))^2} \Delta x)). \ [1]$$

Let this series be $\sum_{i=1}^{\infty} a_i$, where a_i is the summand in [1].

Since

$$\sum_{i=1}^{n} (2\pi f(\kappa) \sqrt{1 + (f'(\kappa))^2} \Delta x) \ [2]$$

is a Riemann sum, it must converge as $n \to \infty$. Call this series $\sum_{i=1}^{\infty} b_i$, where b_i is the summand in [2].

Now, assume that $f > 0$ (or more generally, that $f(x) = 0$ for finitely many x). In that case, $a_n, b_n > 0$ (after, if necessary, discarding the finitely many a_i, b_i which are zero), so the limit comparison test applies.

Since

$$\lim_{n \to \infty} \frac{a_n}{b_n} = 1,$$

it follows that [1] converges to some limit L. That is, we know that for all $\epsilon > 0$, there exists an $N_0 \in N^*$ (where N^* is the set of all natural numbers) such that for all $n \geq N_0$, we have that

$$|\sum_{i=1}^{n} (2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} \Delta x - (2\pi f(\kappa) \sqrt{1 + (f'(\kappa))^2} \Delta x)) - L| < \epsilon.$$

Now, suppose that $L > 0$. Since $\kappa \leq x_i^*$ and $\kappa \leq x_i^{**}$, it follows that $a_i \geq 0$ for all $i \in N^*$. Now, if $a_i = 0$ for all $i \in N^*$, then $|0 - L| = |L| < \epsilon$, satisfying the above condition.

Otherwise, let $\mu = sup_{[x_{i-1}, x_i]} f(x)$. Then, we have that

$$\alpha = \sum_{i=1}^{n} (2\pi f(\kappa) \sqrt{1 + (f'(\kappa))^2} \Delta x) > 0,$$

and it follows that both

$$\beta = \sum_{i=1}^{n} (2\pi f(x_i^{**}) \sqrt{1 + (f'(x_i^*))^2} \Delta x) > 0$$

$$\gamma = \sum_{i=1}^{n} (2\pi f(\mu) \sqrt{1 + (f'(\mu))^2} \Delta x) > 0$$

143

are greater than or equal to $\alpha > 0$. Thus, $|\beta - \alpha| < |\gamma - \alpha|$, and since $|\gamma - \alpha| \to 0$ by Darboux integrability, the Squeeze Theorem implies that $|\beta - \alpha| \to 0$. Thus, $|L| < \epsilon$.

Since we have proven that $|L| < \epsilon$ (in other words, that the desired limit lies within the ϵ-neighborhood), we can say that a_n converges to b_n. b_n is a composition of continuous functions; therefore, it is Riemann-integrable on the interval $[a, b]$. Thus, utilizing the definition of b_n, we have derived the surface area of a solid of revolution as:

$$\int_a^b (2\pi f(x)\sqrt{1 + (f'(x))^2}\Delta x)$$

Or, more simply:

$$2\pi \int_a^b f(x)\sqrt{1 + (f'(x))^2}\,dx.$$

Works Cited

Abbott, Stephen. *Understanding Analysis*. 2nd ed., Springer, 2016.

Dawkins, Paul. "Section 8.2: Surface Area." *Paul's Online Notes*, 2022,
https://tutorial.math.lamar.edu/classes/calcii/surfacearea.aspx.

Representations of Autism in Media: A Content Analysis on Wednesday Addams in 'Wednesday' By Jessie Jin

Abstract

Netflix's recent release of the series 'Wednesday' sparked widespread discussion on the portrayal of Wednesday Addams, the protagonist, for potentially being on the spectrum for autism. This research focused on the question: does the portrayal of Wednesday Addams in Netflix's 'Wednesday' satisfy the DSM-5 criteria of ASD? By performing a content analysis on Wednesday Addams' behaviors based on the DSM-5 criteria for ASD, the researcher concluded that she presented sufficient examples of ASD behavior to satisfy the criteria for a positive diagnosis. The researcher, however, noted that such a diagnosis is only probable as there are limitations to the research method utilized for this paper and the director's intentions for such a portrayal of Wednesday are unknown. This study has future implications in that having a more accurate representation of mental disorders in media will benefit both the general public and those with mental illness, and should thus be explored in greater detail.

Keywords: Wednesday Addams, ASD, DSM-5 criteria, content analysis

Investigating Wednesday: A Content Analysis of Netflix's Wednesday Addams for ASD Traits

Wednesday Addams, the Gothic daughter of the Addams Family, has gained a devoted fan base and enduring popularity over the years dating back to Charles Addams' original rendition of the character. Multiple films, cartoons, and television shows have been made, but on November 23, 2022, Netflix released its reboot show 'Wednesday'. The supernatural mystery starring Jenna Ortega follows Wednesday Addams and her family as she attempts to solve a monster mystery at her boarding school, Nevermore Academy. Over a month after its launch, it remains one of Netflix's most-streamed shows and continues to break records (Havermale, 2022). The protagonist, in particular, is praised by the media due to her appearance and relatable personality (Zara, 2022). However, there is an issue as despite the original source material not presenting Wednesday Addams as autistic (Craig, 2022), her behavior and speech have pushed many into claiming that she may be on the autism spectrum (Crimmins, 2023). Such disorders are most commonly assessed using the Diagnostic and Statistical Manual of Mental Disorders,

fifth edition, also known as DSM-5 (Friedman et al., 2011). Misrepresenting mental disorders fosters the stigma associated with them as well as individuals who have been diagnosed or self-identify with them (Corrigan & Watson, 2002). They also found that this can distort the public's understanding, causing a misinterpretation of mental disorders (Corrigan & Watson, 2002). Due to these potential implications, the following research question has been developed: does the portrayal of Wednesday Addams in Netflix's 'Wednesday' satisfy the DSM-5 criteria?

Definitions

Mental disorder: "A mental disorder is a syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or development processes underlying mental functioning." (American Psychiatric Association, 2013). Mental disorder can be referred to as mental illness and it is also known as a wide range of mental health conditions or issues "that affect your mood, thinking, and behavior." ("Mental illness", 2022).

Mental health: Mental health is "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" ("Promoting Mental Health", 2004).

DSM-5: The Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), is the most current "classification system of psychopathology to standardize the diagnostic terms used when diagnosing individuals with mental disorders" used by mental health systems around the world, particularly the United States (Ma, 2022).

Autism Spectrum Disorder: Autism spectrum disorder (ASD) is a condition related to brain development that impacts how a person perceives and socializes with others, causing problems in social interaction and communication. The disorder also includes limited and repetitive patterns of behavior. The term 'spectrum' in autism spectrum disorder refers to the wide range of symptoms and severity." ("Autism Spectrum disorder", 2018).

Literature Review

This review of literature explores the portrayal of mental disorders in media, how they are depicted and the effects such portrayals have on the general public and individuals with

mental disorders. Furthermore, the review examines the negative and positive portrayals of ASD in the media.

Mental Disorders Portrayed in Media

Much research in the past has been done on studying mental disorders portrayed in mass media. Wahl (1992) conducted a major study reviewing prior studies from the 1950s through the 1990s that addressed the frequency, accuracy, and subsequent impact of portrayals of mental illness in the mass media. His findings revealed that mental illness was depicted in multiple forms of mass media and was not restricted to any particular medium (Wahl, 1992). Research investigating mental illness images in media also found that attitudes toward mental health were heavily influenced by mass media sources (Taylor, 2008). The portrayals demonstrated through various media were found to be "the general public's most significant source of information about mental illness and psychiatric disorders." (Cloverdale et al., 2001). This finding was reinforced by surveys conducted by the Robert Wood Johnson Foundation (2017), indicating that mass media were the most common sources of public information about mental illness. Reavley and Jorm (2010) determined that the most popular source of mental illness in media was television which is also by far the most investigated medium. This can be supported by Taylor's (1957) findings which showed that more than 100 hours of television programming from a single network revealed that 2.3 programs per day contained material regarding mental illness.

Analyzing the collected data indicated that the mass media is most responsible for public understanding of mental illnesses, thus suggesting that their depiction is crucial for any research in this area. In their study, Butler and Hyler (2005) explored Hollywood portrayals of child and adolescent mental health treatment and discovered that the "mystification of various disorders" generated misconceptions within public understanding. This view was supported by Wahl's study (1992) which reported mental illness portrayals in media to be consistently inaccurate and unfavorable as people with mental illness were frequently labeled inadequate, unlikeable, and dangerous. The analysis of mental disorders stigma in media conducted by Klin and Lemish (2008) revealed distorted portrayals were due to "inaccuracies, exaggerations, or misinformation." This study had similar outcomes to Wahl (1992) as it also found that those with mental illnesses were depicted as being peculiar, different, and dangerous.

Such inaccuracies perpetuate stigma around mental disorders and several different studies have explored such impacts on specific disorders. For example, Ruth Allen and Raymond G. Nairn (1997) examined news stories and fictional media depictions of mental illness using content analysis. The results showed that media portrayals of people with mental illness as dangerous perpetuated negative perceptions and stigma, suggesting a negative impact the media may have on public perception and understanding of mental illness (Allen & Nairn, 1997). One study by Parrott and Parrott (2015) specifically focused on the representation of mental illness in U.S. crime dramas. By analyzing the frequency and nature of those representations in a sample, the results showed that characters with mental illness were more likely to commit crimes and violence than the other characters (Parrott & Parrott, 2015). The researchers emphasized the need for more factual and sensitive media portrayals of mental illness to reduce stigma and increase accurate understanding (Parrott & Parrott, 2015). While reviewing existing research, Smith (2015) discovered that media reinforced stereotypes and negative perceptions of mental disorders and media portrayals of mental disorders often rely on stereotypes. Media, especially television, portrayed mentally ill individuals as violent (Singoreilli, 1989) and incapable of being "productive members of society" (Wahl, 1982). Looking at specific types of mental disorders, Fennell and Boyd (2013) focused on the portrayals of obsessive-compulsive disorder (OCD) in fictional media from the 1970s to the 2000s. The data indicated that while media images of OCD reinforced common negative stereotypes of mental illness, the media also portrayed people with OCD as relatively intelligent and functional (Fennell & Boyd, 2013). This showed instances that differ from stereotypical portrayals and instead portray mental illness positively. However, there was limited evidence to support the prevalence of such positive media portrayals.

Effects of Media Portrayals of Mental Disorders

Several studies have demonstrated that media portrayals of mental disorders can have substantial effects on the general public and those who have been diagnosed or self-identify with mental disorders.

Effects of Media Portrayals of Mental Disorders on the General Public

The accumulated research indicated that the media has a powerful influence on the general public's attitudes and behaviors. Ma's study (2016) highlighted the need for responsible

and nuanced media representation of mental health as a review of existing literature showed that the media had the power to shape public opinion and influence attitudes toward mental illness. An experiment by McGinty et al. (2013) tested the impact of news stories about mass shootings carried out by people with Serious Mental Illness (SMI) and found that attitudes of the general public were swayed negatively and promoted demands for greater gun control people with SMI. Pirkis et al. (2006) investigated the depiction of mental illnesses as well as their treatments within film and television. This study considered the impacts of such depictions on the general public and found that certain illnesses such as schizophrenia, dissociative identity disorders, and amnesia were overrepresented due to their potential for dramatic storylines, creating an impression of greater prevalence than reality in the general public (Pirkis et al., 2006). In addition, the researchers also found that medical treatments were also represented by their use for dramatic effect rather than their medical efficacy, citing, in particular, the portrayal of electroconvulsive therapy as negatively impacting patient well-being and rarely depicting it as yielding positive results (Pirkis et al., 2006).

Angermeyer and Dietrich (2005) noted in their review of the literature that those who associated schizophrenia with "the idea of unpredictability and dangerousness" had the greatest desire to socially distance themselves from people with schizophrenia. A particular example cited was the "marked increase of the preference for social distance from people with schizophrenia immediately following violent attacks by two individuals suffering from schizophrenia against prominent German politicians." (Angermeyer & Matschinger, 1995). Similarly, research carried out by Diefenbach and West in 2007 has shown that those who regularly watched television news were less likely to live in close proximity to people with mental illness. Moreover, the same study suggested that the media's representation of people with mental health disorders as dangerous criminals could influence people's perceptions of their safety if mental health facilities were moved to their neighborhoods (Diefenbach & West, 2007). These studies indicated that media representation has a significant impact on how the general public interacts with and perceives those with mental illness.

Effects of Media Portrayals of Mental Disorders on People With Mental Disorders

Another area of investigation explored by researchers was the impact of media influence on individuals with mental disorders. A study concerned specifically with Hollywood portrayals

of mental illness in adolescents and children by Butler and Hyler (2005) found that contrary to previous research findings, television could be a "supportive teaching tool". For example, a teenager diagnosed with bipolar disorder and antisocial behavior felt empowered by the depiction of Angelina Jolie's character in the movie "Girl, Interrupted" as the two shared similar patterns of behavior and symptoms (Butler and Hyler, 2005). However, Butler and Hyler's (2005) results were not supported by the majority of researched reviews for this literature review.

A survey in the UK created by Baker and MacPherson (2000) revealed that three-quarters of those who use mental health services reported that the media's portrayal of mental health was "unfair, negative, and unbalanced," and half suggested these portrayals negatively impacted their mental health. One-third reported that their relatives and friends had acted differently toward them as a result of negative media representations, one-third of respondents reported that such representations discouraged them from looking for jobs or volunteering, and one-quarter of respondents reported experiencing hostility from neighbors and local communities (MacPherson, 2000). It has been well documented in existing research (Stuart, 2006) that media representation of mental illness can have a profound effect on the general public's understanding as well as the perception of mental disorders and can directly impact individuals with mental disorders. The accumulated findings from studies conducted in this area indicate that media portrayals of mental illness tend to have more negative effects than positive effects.

ASD Portrayed in Media

Autism Spectrum Disorder (ASD) was recognized as one of the more common neurodevelopmental disorders (Baird et al., 2006). However, most people would not have had substantial or direct contact with people on the autism spectrum and, as a result, must draw their understanding from other sources. Even when personal experience was available, people may have relied on media representations to understand how the experience relates to the broader range of presentations, thus contributing to the prevalent stereotyped attitudes (Draaisma, 2009; Garner et al., 2014). In recent years, there has been increased representation of ASD characters in the media that created greater public awareness about autism (Baron-Cohen, 2015), however, Nordhal-Hansen's (2017) research suggested that while the increased exposure has shaped public discourse and perception, there was a potential risk that misperceptions and incomplete narratives are creating inaccurate and incomplete understandings of autistic persons.

Negative Portrayals of ASD in Media

Although ASD has become increasingly represented in media, there remain many negative portrayals of autistic individuals. One popular trope of ASD in media was the depiction of people with autism as being incapable of living independently (Conn & Bhugra, 2012; Garner et al., 2015; Prochnow, 2014). As these persons were shown to require assistance with daily needs, they were deprived of their agency and only capable of surviving with the intervention and assistance of others. This created a narrative that portrays them as weak or incapable, affecting how the general public may view them. This state was also often portrayed to necessitate lifelong care, suggesting an eternal burden on family members (Allen, 2017). In addition, persons with ASD were often depicted to be the cause of violence within the family unit, with media frequently depicting family members displaying maladaptive coping behaviors due to children with autism (Allen, 2017). Such depictions reinforced negative public understanding of autistic persons being impossible to manage or having a negative impact on family dynamics.

Another common portrayal of ASD in media, particularly news media, was the suggestion of a link between ASD and violence (Ressa, 2021). Despite the lack of academic evidence proving such, such portrayals in the media created a misinformed and negative public understanding that autistic individuals had an increased likelihood of committing "acts of violence or being a danger to society." (Ressa, 2021). Such portrayals were influenced by the sensationalistic and dramatic reporting of certain crimes committed by those with ASD, thus perpetuating a belief in the public that only those who were of unsound mind or autistic were capable of committing such crimes. (Wesseley, 2012) This was accomplished by "speculative headlines such as "Expert says Norway killer has Asperger's, Tourette's syndromes" (Agence France-Presse, 2012) or "Relative Says Virginia Tech Shooter Was Autistic" (Associated Press, 2007) which implied that the criminal acts were caused by the disorder, severely negatively impacting the public perception of autistic persons. Such inaccurate representation led to a false understanding and perception of ASD and further contributed to stigmatization and discrimination against autistic people. Such stereotypes clouded autism characteristics, especially when merged with normal behaviors, making it difficult for the autism community to claim their identity (Draaisma, 2009).

Positive Portrayals of ASD in Media

Persons with ASD were also portrayed in a positive light, especially on television. Berryessa (2014) interviewed members of the judiciary regarding their perceptions of media representing ASD and the results were that the judges who perceived it as positive focused on how "exposure brings a better understanding and acceptance of the disorder." Specifically, according to Draaisma (2009), general viewers of media that feature savant autistic characters were more likely to believe that autistic people have different talents. McHue's (2018) analysis of how autism was portrayed in the crime drama genre concluded that neurodiverse detectives are commonly portrayed as defective or dysfunctional but excelling in their detective work, which reinforced the savant stereotype (Garner et al., 2015). Another example of positive media portrayals was how the lack of social skills commonly associated with autistic individuals was presented in a manner that depicted such persons as possessing a childlike innocence and being incapable of lying. One example is the television show 'The Good Doctor' in which the savant autistic protagonist, Shaun Murphy was judged to be "incapable of deceit" when he was thought to have concealed information from his girlfriend (Ressa & Goldstein, 2021).

Lee and Deng (2020) concluded that while the Netflix show 'Atypical' had flaws including the exaggeration of positive traits for dramatic effects, the overall portrayal presented "thoughtful representations of individuals with ASD by incorporating voices from the autism community and bringing additional actors, consultants, and a playwright with ASD into the production." During their analysis, Belcher and Maich (2014) investigated the presentation of persons with ASD across multiple media formats and concluded that such works often portrayed "more exaggeration than reality for the cause of entertainment". Their examination of five television series revealed that each of the characters with ASD were presented as larger-than-life heroes who overcame impossible odds in abnormal or extreme situations unreflective of daily life (Belcher & Maich, 2014). As a result of these portrayals, Belcher and Maich (2014) concluded that viewers of such shows could be "led to believe that those with ASD have heroic abilities in times of crisis, or intuitively solve problems that the average person may not". Overall, a review of the literature illustrates that while negative portrayals of ASD continue to exist, there is a trend for modern portrayals to be positive or at the very least well-intentioned.

This literature review was conducted to address the research question: does the portrayal of Wednesday Addams in Netflix's 'Wednesday' satisfy the DSM-5 criteria of ASD. The

findings suggest that media depictions of mental disorders are often inaccurate and can cause the general public to develop distorted perceptions and misunderstandings. Such depictions can have a direct impact on those who have mental illness, leading to warped self-perception and differential treatment by others. Additionally, the media portrayals of ASD exist on both positive and negative ends of the spectrum. Although researchers have used the DSM-5 criteria in the past to analyze characters in film or television, none have conducted their studies on Wednesday Addams. Thus, the researcher wants to take this opportunity to fill this gap of research by evaluating Wednesday Addams' suitability as a candidate for ASD. The DSM-5 criteria for ASD will be used to conduct this study. The researcher will use it when examining episodes of the Netflix series to diagnose Wednesday Addams. An accurate diagnosis of the character may provide more clarity and a better understanding of the public discourse around Wednesday Addams as well as portrayals of autism spectrum disorder. The public or viewers may benefit from this research as the results will help identify the accuracy of their interpretations and educate them on how their understanding may or may not be misguided. Moreover, this study may help those that have or self-identify as having ASD to perceive themselves differently or be treated differently by others. The researcher's intention for this study is to provide direction and value for future research on character analysis as well as educate the general public on mental disorders, with a focus on ASD.

Problem Statement

There is a problem with how some viewers of the Netflix show 'Wednesday' believe that the eponymous protagonist Wednesday Addams is on the autistic spectrum based on her speech and behavioral patterns. This research paper seeks to address this by evaluating her suitability as a candidate for Autism Spectrum Disorder (ASD).

Methodology

In order to see if the portrayal of Wednesday Addams in Netflix's 'Wednesday' satisfy the DSM-5 criteria of ASD, the researcher used a qualitative method, content analysis, to collect data that satisfies the coding categories created from the DSM-5 criteria. The DSM-5 criteria promote greater accuracy and reliability in diagnosis (Stinchfield et al., 2016). The utilization of content analysis for this research was needed due to the adoption of the criteria as a diagnostic

checklist (see Appendix 1) for Wednesday Addams which required deeper analysis. Content analysis is a qualitative research approach employed to identify, analyze, and interpret different trends and patterns of themes, words, meanings, relationships, and/or concepts (Bengtsson, 2016). It involves coding categories to organize large volumes of data and information. Many researchers have used content analysis as a tool to analyze behavior in film or television (Macnamara, 2005).

The researcher's original approach was to combine content analysis with a quantitative method but this approach was discontinued as certain elements were irrelevant and unnecessarily complicated the study. As this study revolves around the observation and examination of behavior, the qualitative method was considered superior as it allowed for better analysis and understanding of behavioral nuances that might not be fully captured by quantitative research. In particular, the qualitative approach utilized by one study (Young, 2012) found during the conduct of the literature review was deemed suitable for application in this study. Young's (2012) research focused on the representation of autism in film and television which is directly relevant to this study and used content analysis as part of her research. The study demonstrated that analyzing characters in different contexts for the determination of autistic behavior was possible using content analysis and thus proving the method both applicable and appropriate for the current study. It is important to note that the researcher did not replicate the method and only took the paper as inspiration and guidance. This study focused on the eponymous character of Netflix's 'Wednesday' as there is limited research available on the recent release of the series, despite the widespread popularity of Wednesday as a character (Zara, 2022). The accurate portrayal of the character on-screen may have an impact, making this study both relevant and crucial.

To ensure that the data collection could be replicated, the researcher created a logical and structured method, and each time they analyzed an episode, the same procedure was used to maintain consistency. As the researcher analyzed one character, there is a population of one that was studied. While there are a total of eight total episodes in the series, the researcher was unable to perform content analysis on the whole series due to time constraints (this will be taken into account as a limitation). Thus, 50% of the population size (8/2 = 4) was chosen to ensure accuracy and that the analysis is representative of the character. They employed a simple random sampling by utilizing an online random number generator from Calculator.net to determine the

four episodes and thus reducing researcher bias. As the protagonist, Wednesday Addams receives a large amount of screen time per episode, inclusion criteria were not required. Therefore, there were no rejected samples. As the variables of this study could not be measured directly, the researcher crafted a procedure for quantifying conceptual ideas into measurable observations. This was done by creating 13 coding categories based on the seven categories in DSM-5 criteria for ASD and was recorded on a Google spreadsheet as raw data (see Appendix 2.1). In the spreadsheet, the columns were sorted by the episode number, the length of each episode (in minutes), and the 13 coding categories. As the DSM-5 is the official criteria for diagnosis of ASD, the researcher broke down the guidelines into individual coding categories based on the different descriptions specified in DSM-5. These categories were verbal communicative behavior, nonverbal communicative behavior, abnormal social interactions, emotions expressed, difficulty and deficits in maintaining relationships, repeated behavior, repeated interests, repeated activities, resistance to change, abnormal interests, hyper fixation, and hyper-reactivity as well as hypo-reactivity to sensory input. While watching each episode, the researcher recorded the starting time stamp and a summarized description for each potential example of ASD behavior. The collated data of potential examples was then reviewed against the appropriate descriptions used by the criteria and assessed on whether they satisfy it. Each example recorded was closely re-examined and carefully considered to see if it was correctly categorized. Examples that have been miscategorized were moved and applied to a more appropriate category, split between several accurate categories, or deemed to be unsuitable for any category. If the example failed to satisfy any criteria, it was eliminated as a supporting characteristic for diagnosing Wednesday Addams with ASD. These changes were recorded in a separate Google Spreadsheet as clean data (see Appendix 2.2). This method allowed the researcher to address the research question as the same criteria of assessment were used for the diagnosis of ASD.

Results

Content analysis was used to collect data on potential ASD behaviors that Wednesday Addams demonstrated in four randomly selected episodes, episodes one, four, six, and seven, to examine whether she could be on the autism spectrum. This method provided the most accurate and detailed analysis available, making it the approach best suited for the study (Bengtsson, 2016). Data of potential ASD behaviors were visualized in figure set 1 whereas the data for

confirmed ASD behaviors were visualized in figure set 2. The purpose of dividing these data sets was to improve accuracy for the diagnosis by including a second level of analysis that took context into account. Further details can be found in the methodology section of this paper.

Figure Set 1

The raw data collected for potential ASD behaviors on Wednesday Addams can be found in Appendix 2.1. The purpose of visualizing the raw data was to organize it to enable easier analysis and identify notable trends, outliers, and possible implications of this study. For clearer understanding and finer detail, the data has been separated into the following four segmented bar graphs.

Figure 1.1 shows potential verbal communicative behaviors, nonverbal communicative behaviors, and abnormal social interactions in episodes one, four, six, and seven.
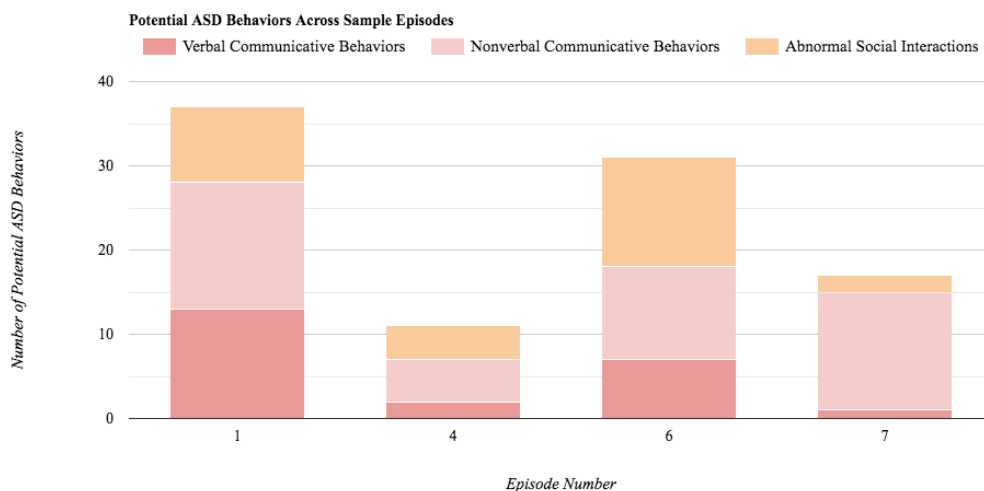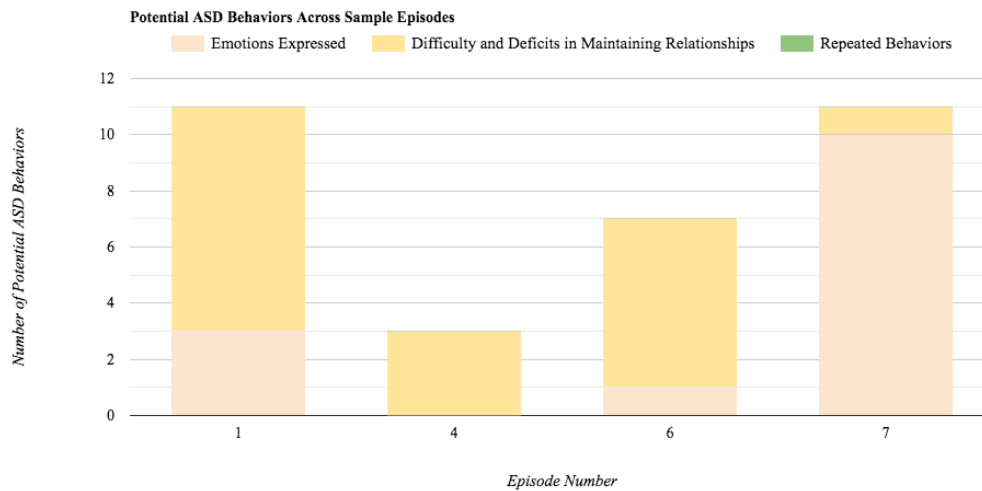

Figure 1.1 Segmented Bar Graph of Potential ASD Behaviors Across Sample Episodes.

Out of the three categories, the most common behavior observed was nonverbal communicative behaviors at 45 while the least common behavior was verbal communicative behaviors at 23. Episode one had the most number of behaviors observed at 37 while episode four had the least number of behaviors at 11.

Figure 1.2 shows potential emotions expressed, difficulty and deficits in maintaining relationships, and repeated behaviors in episodes one, four, six, and seven.
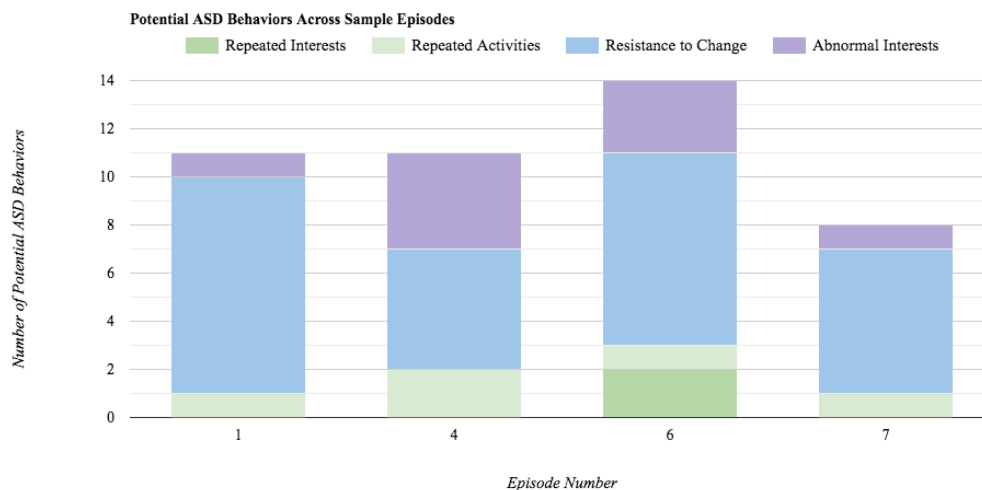
Figure 1.2 Segmented Bar Graph of Potential ASD Behaviors Across Sample Episodes.

Potential ASD Behaviors Across Sample Episodes

Out of the three categories, the most common behavior observed was difficulty and deficits in maintaining relationships at 18. While there were repeated behaviors were observed throughout all four episodes, they were not included in this count for reasons that will be further analyzed in the discussion section. Episodes one and seven had the most number of behaviors observed at 11 while episode four had the least number of behaviors at three.

Figure 1.3 shows potential repeated interests, repeated activities, resistance to change, and abnormal interests in episodes one, four, six, and seven.

Figure 1.3 Segmented Bar Graph of Potential ASD Behaviors Across Sample Episodes.

Potential ASD Behaviors Across Sample Episodes

Out of the four categories, the most common behavior observed was resistance to change at 28 while the least common behavior was repeated interests at two. It was observed twice and only in episode six. Episode six had the most number of behaviors observed at 14 while episode seven had the least number of behaviors at eight.

Figure 1.4 shows potential hyper fixation, hyper-reactivity to sensory input, and hypo-reactivity to sensory input in episodes one, four, six, and seven.

Figure 1.4 Segmented Bar Graph of Potential ASD Behaviors Across Sample Episodes.
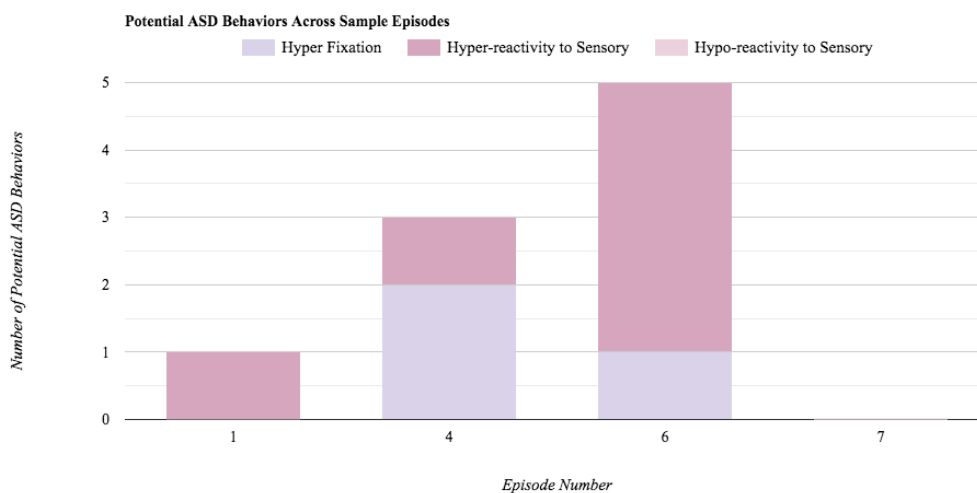
Out of the three categories, the most common behavior observed was hyper-reactivity to sensory input at six while there was zero hypo-reactivity to sensory input observed throughout all four episodes. Episode six had the most behaviors observed at five while episode seven had no behaviors. There were no observed behaviors in episode seven.

Comparing all four figures, the most common behavior observed in all four episodes was nonverbal communicative behaviors at 45 while there were zero repeated behaviors and hypo-reactivity to sensory input observed. Episode one had 60 behaviors observed, episode four had the least number of behaviors at 29, episode six had the most number of behaviors at 65, and episode seven had 37.

Figure Set 2

The data collected that has been refined to only include confirmed behaviors on Wednesday Addams can be found in Appendix 2.2. The purpose of visualizing the confirmed

behaviors was to organize the content analysis which will be used to answer the research question. For clearer understanding and finer detail, the data has been separated into the following four segmented bar graphs.

Figure 2.1 shows confirmed verbal communicative behaviors, nonverbal communicative behaviors, and abnormal social interactions in episodes one, four, six, and seven.

Figure 2.1 Segmented Bar Graph of Confirmed ASD Behaviors Across Sample Episodes.
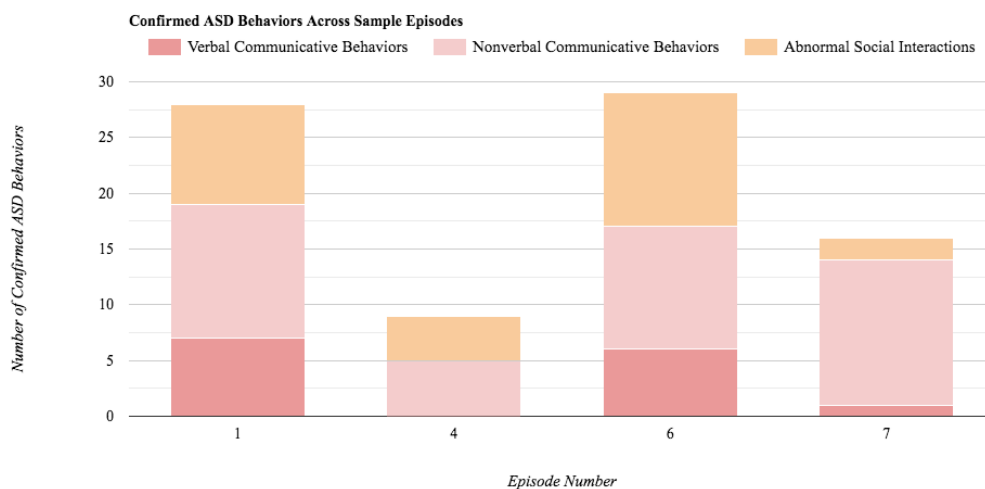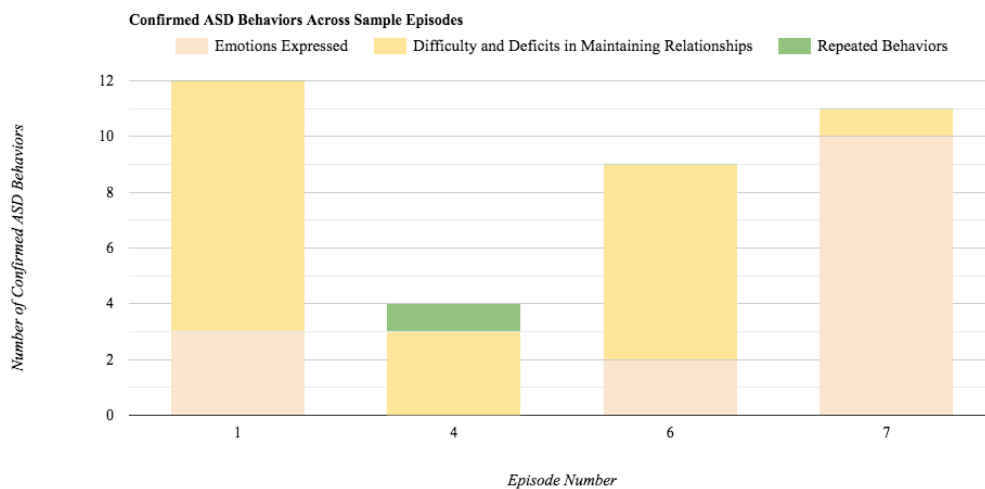

Figure 2.2 Segmented Bar Graph of Confirmed ASD Behaviors Across Sample Episodes.

Out of the three categories, the most common behavior observed was difficulty and deficits in maintaining relationships at 20 while the least common behavior was repeated behaviors at one. It was observed once and only in episode four. Episode one had the most number of behaviors observed at 12 while episode four had the least number of behaviors at four.

Figure 2.3 shows confirmed repeated interests, repeated activities, resistance to change, and abnormal interests in episodes one, four, six, and seven.

Figure 2.3 Segmented Bar Graph of Confirmed ASD Behaviors Across Sample Episodes.
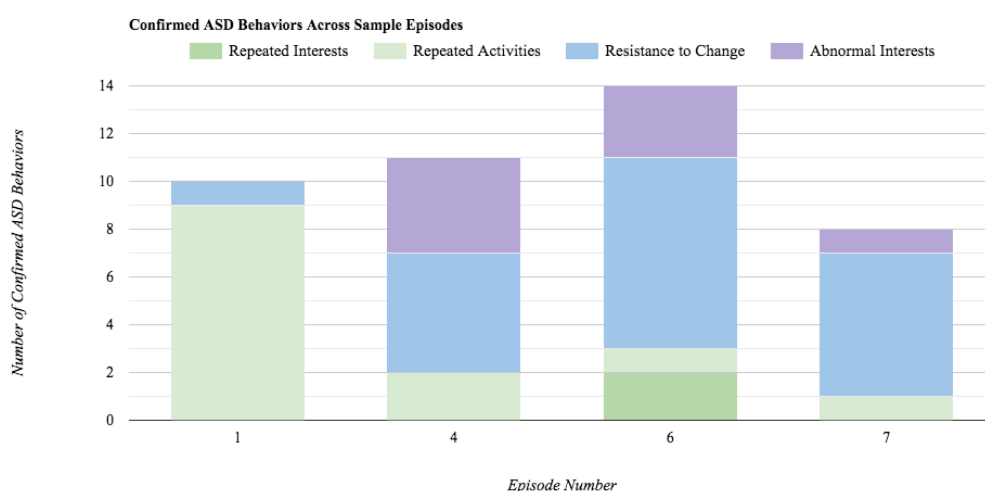
Out of the three categories, the most common behavior observed was resistance to change at 28 while the least common behavior was repeated interests at two. It was observed twice and only in episode six. Episode six had the most number of behaviors observed at 14 while episode seven had the least number of behaviors at eight.

Figure 2.4 shows confirmed hyper fixation, hyper-reactivity to sensory input, and hypo-reactivity to sensory input in episodes one, four, six, and seven.

Out of the three categories, the most common behavior observed was hyper-reactivity to sensory input at five while there was zero hypo-reactivity to sensory input observed throughout all four episodes. Episode six had the most number of behaviors observed at four while episodes one and seven had the least number of behaviors at one. Episode one had hyper-reactivity to sensory input observed once and episode seven had hyper fixation observed once.

Comparing all four figures, the most confirmed behavior observed in all four episodes was nonverbal communicative behaviors at 41 while zero hypo-reactivity to sensory input was
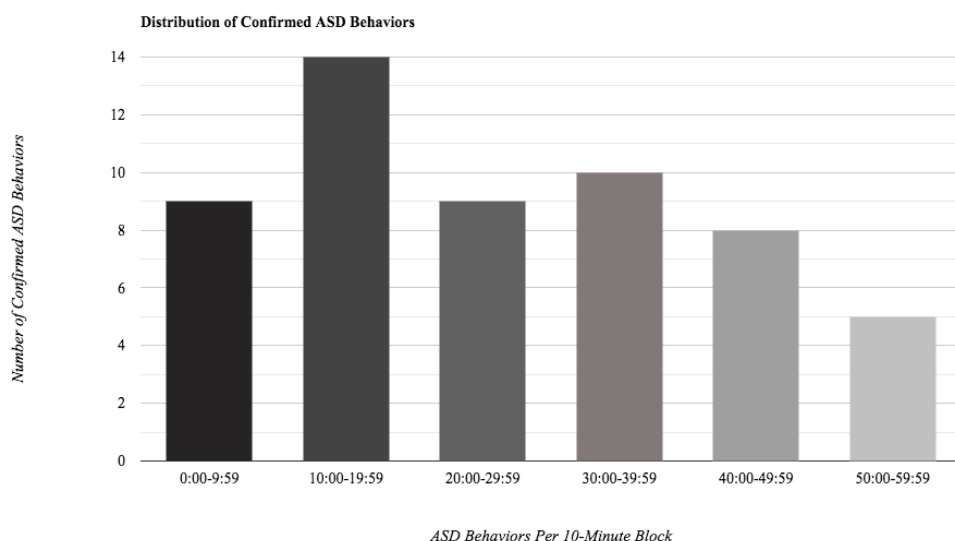
observed. Episode one had 51 behaviors observed, episode four had the least number of behaviors at 27, episode six had the most number of behaviors at 56, and episode seven had 36. Comparing figure set 1 with figure set 2, there appeared to be an insignificant difference as there were only 18 removals and five reclassifications done out of the 191 potential ASD behaviors observed, leaving 170 confirmed ASD behaviors.

Figure Set 3

The following four bar graphs visualize the distribution of the confirmed ASD behaviors by each of the randomly selected episodes. This was to assist with the identification of any discernible patterns or trends in behavior that may have been intentionally introduced for developing the plot at critical points of each episode. The confirmed ASD behaviors were plotted against a timeline of each episode that was divided into 10-minute blocks to provide a breakdown of when the confirmed ASD behaviors presented throughout episodes one, four, six, and seven. As each episode had varying lengths, this potentially impacted the number and type of behaviors observed in the episodes and will be explored in greater detail in the discussion.

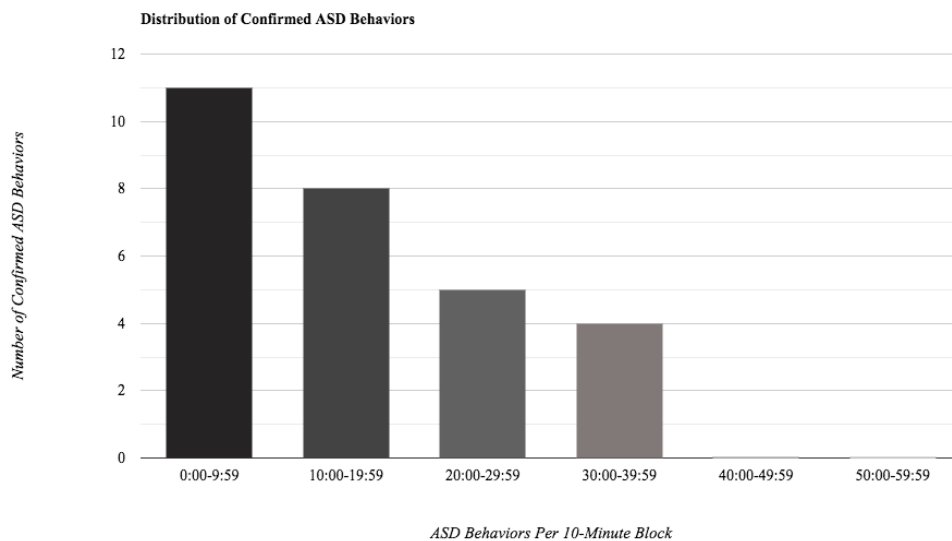Figure 3.1 shows the distribution of confirmed ASD behaviors in episode one in six 10-minute blocks.

Figure 3.1 Distribution of Confirmed ASD Behaviors in Episode One.

Distribution of Confirmed ASD Behaviors

Number of Confirmed ASD Behaviors

ASD Behaviors Per 10-Minute Block

In episode one, from 0:00-9:59, there was a total of nine confirmed behaviors observed. From 10:00-19:59, there was a total of 14 confirmed behaviors observed. From 20:00-29:59, there was a total of nine confirmed behaviors observed. From 30:00-39:59, there was a total of 10 confirmed behaviors observed. From 40:00-49:59, there was a total of eight confirmed behaviors observed. From 50:00-59:59, there was a total of five confirmed behaviors observed.

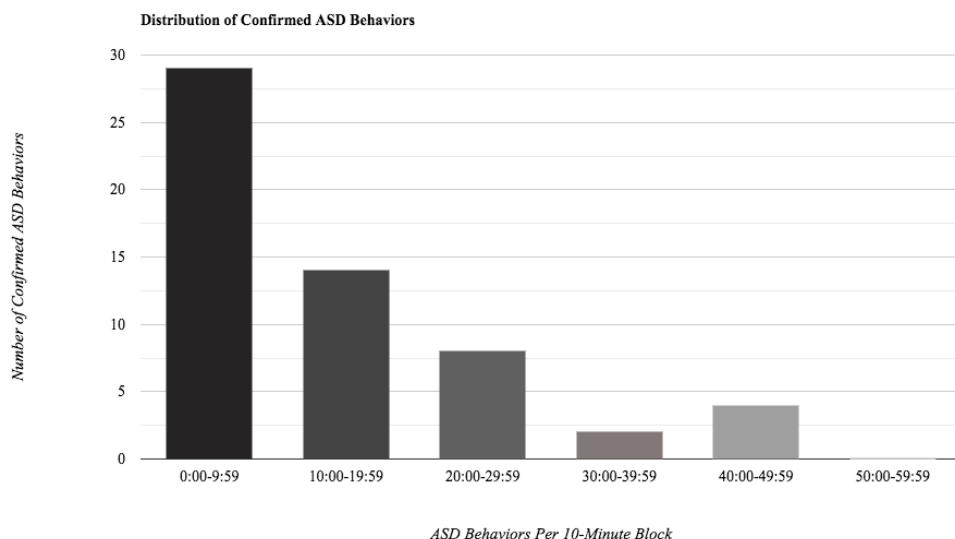Figure 3.2 shows the distribution of confirmed ASD behaviors in episode four in six 10-minute blocks.

Figure 3.2 Distribution of Confirmed ASD Behaviors in Episode Four.

Distribution of Confirmed ASD Behaviors

In episode four, from 0:00-9:59, there was a total of 11 confirmed behaviors observed. From 10:00-19:59, there was a total of eight confirmed behaviors observed. From 20:00-29:59, there was a total of five confirmed behaviors observed. From 30:00-39:59, there was a total of four confirmed behaviors observed. From 40:00-49:59, there was a total of zero confirmed behaviors observed. From 50:00-59:59, there was a total of zero confirmed behaviors observed.

Figure 3.3 shows the distribution of confirmed ASD behaviors in episode six in six 10-minute blocks.

Figure 3.3 Distribution of Confirmed ASD Behaviors in Episode Six.

Distribution of Confirmed ASD Behaviors

In episode six, from 0:00-9:59, there was a total of 29 confirmed behaviors observed. From 10:00-19:59, there was a total of 14 confirmed behaviors observed. From 20:00-29:59, there was a total of eight confirmed behaviors observed. From 30:00-39:59, there was a total of two confirmed behaviors observed. From 40:00-49:59, there was a total of four confirmed behaviors observed. From 50:00-59:59, there was a total of zero confirmed behaviors observed.

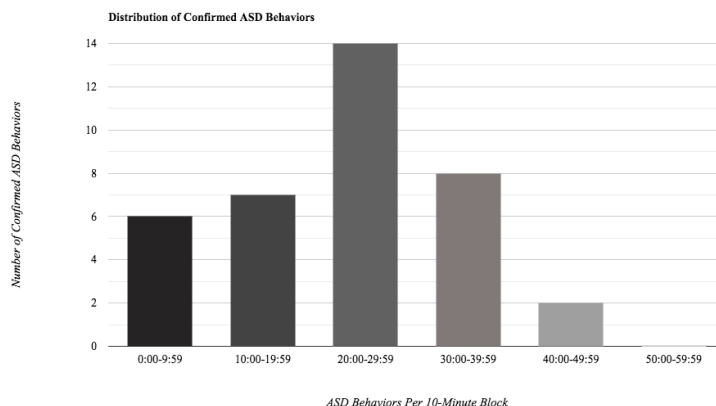Figure 3.4 shows the distribution of confirmed ASD behaviors in episode seven in six 10-minute blocks.

Figure 3.4 Distribution of Confirmed ASD Behaviors in Episode Seven.

Distribution of Confirmed ASD Behaviors

In episode seven, from 0:00-9:59, there was a total of six confirmed behaviors observed. From 10:00-19:59, there was a total of seven confirmed behaviors observed. From 20:00-29:59, there was a total of 14 confirmed behaviors observed. From 30:00-39:59, there was a total of eight confirmed behaviors observed. From 40:00-49:59, there was a total of two confirmed behaviors observed. From 50:00-59:59, there was a total of zero confirmed behaviors observed. Analyzing the four episodes revealed that confirmed behaviors present most often in the 00:00-9:59 block at 55 observations out of the 177 total confirmed observations.

Discussion

In order to answer the research question does the portrayal of Wednesday Addams in Netflix's 'Wednesday' satisfy the DSM-5 criteria of ASD, the content analysis must be unpacked and examined in greater detail. During the content analysis, it was found that Wednesday Addams consistently presented behaviors that could be identified as ASD behaviors as presented in figure set 1. Upon closer contextual analysis, it was found that some of these potential behaviors had to be reclassified or invalidated as presented in figure set 2. Finally, it was noted that ASD behaviors were frontloaded in each episode of the sample as seen in figure set 3.

Wednesday Addams Consistently Presented ASD Behaviors

Through observing Wednesday Addams' behaviors with the coding categories, results show that she demonstrated consistent and high levels of ASD behavior per episode. According to the DSM-5 checklist (Oregon Health & Science University, 2013), an individual can only satisfy the first section of behaviors if they manifest all three descriptions and the second section if they manifest two of the four descriptions. The second content analysis noted a total of 51, 27, 56, and 36 confirmed ASD behaviors in episodes one, four, six, and seven respectively. A closer analysis reveals that the first requirement of the checklist, manifesting all three descriptions, is satisfied. This can be seen in figures 2.1 and 2.2 which illustrate that examples of "deficits in nonverbal communicative behaviors used for social interaction", "deficits in social-emotional reciprocity", and "deficits in developing and maintaining relationships appropriate to developmental level" (Oregon Health & Science University, 2013) were recorded in all four episodes of the sample. Furthermore, the second requirement of the checklist, manifesting two of the four descriptions, is satisfied. This can be seen in figure 2.3 which illustrates that examples of

"excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change" and "highly restricted, fixated interests that are abnormal in intensity or focus" (Oregon Health & Science University, 2013) were recorded in all four episodes of the sample. Although "hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment" (Oregon Health & Science University, 2013) was not observed in all four episodes, it is noteworthy that examples of such behavior were recorded for three out of the four episodes as illustrated in figure 2.4. Despite its prevalence, this was deemed to not have satisfied the requirement as it did not occur in all four episodes, and thus was removed to reduce the risk of diagnostic inaccuracy.

While the minimum requirement for a positive diagnosis was achieved, it must be noted that other researchers have observed that ASD behaviors have been used for entertainment purposes. The majority of portrayals of autistic persons in entertainment media such as television shows and films were found to have used autistic characters as a "plot device" (Jones, 2022) and an analysis of mental disorders stigma revealed portrayals were partly due to exaggerations (Klin and Lemish, 2008). Additionally, Lee and Deng (2020) noted that ASD traits were exaggerated for dramatic effect in their analysis of other television shows. Therefore, the intentional use of ASD behaviors observed in 'Wednesday' may have been to present the protagonist as autistic or to display ASD coded behaviors as a tool to engage the audience throughout the series.

Some Potential Behaviors were Invalidated or Reclassified after Detailed Analysis

Content analysis was performed to identify if shortlisted behaviors are considered ASD behavior, with each example being examined in the show's context to minimize plot interference and misidentification. The 13 coding categories were derived from the seven criteria of the DSM-5 checklist found in Appendix 2.

Excluded ASD Behaviors Due to Signal-to-Noise: Repeated Behaviors & Hyper Fixation

It is crucial to recognize that some details (repeated behaviors and hyper fixation) were excluded despite being classified as ASD behaviors due to the potential to conflate such behaviors with behaviors necessary for plot progression. Wednesday's typical demeanor in all four episodes included repeated behaviors such as constantly having a rigid gait, walking stiffly with minimal movement (limited range of motion in her arms and legs as well as limited sway and rotation when she moved), staring, minimal blinking, and displaying the same expressionless

face. These repeated behaviors also satisfy the DSM-5 criteria for ASD as they are examples of deficits in nonverbal communicative behaviors which include "abnormalities in eye contact and body- language…total lack of facial expression or gestures." (Oregon Health & Science University, 2013). The researcher chose to exclude this type of behavior in their content analysis as such behaviors were consistently and constantly identified, to the point where recording such samples would have overwhelmed or overshadowed the other data samples due to its prevalence, thus reducing overall accuracy of the study. Hence, these examples were not recorded but still considered ASD behavior when diagnosing Wednesday. As the plot of "Wednesday" focuses on Wednesday solving the mystery of Hydes and her mission to save Nevermore Academy, it is necessary for her to be fixated on the task, leading her to take any action needed to do so. While the degree to which she becomes obsessed with solving the mystery could be considered an example of her hyper-fixation tendencies, her fixation is essential for the plot of the series. As such, it was impossible to separate hyper-fixative behavior inspired by ASD and such behavior inspired by the plot. Thus, such identified behaviors were excluded for the purposes of accuracy.

Confirmed ASD Behavior Example

One example of confirming a potential ASD behavior occurred during episode four when Wednesday attended her school dance, the Rave'N, with Tyler Galpin. Enid Sinclair (Wednesday's roommate) took Lucas, who worked with his friends to fill the sprinklers with fake blood. Toward the end of the dance, they turned on the sprinklers, drenching everyone and causing a panic amongst everyone except Wednesday. While the other students scrambled for cover, Wednesday continued to stand in the shower of blood till she was fully drenched, smiling and remaining shockingly still and nonchalant (39:37). This was confirmed as an ASD behavior because it demonstrated her lack of expressions and gestures which satisfy the description for "deficits in nonverbal communicative behaviors used for social interaction" (Oregon Health & Science University, 2013).

Reclassified ASD Behavior Example

One example of reclassifying an observed ASD behavior occurred during episode one when Wednesday's mother, Morticia Addams, said goodbye to Wednesday as she moved to Nevermore Academy, Morticia attempted to touch her shoulder but Wednesday's face immediately showed visible discomfort and moved away from her mother (16:32). This was originally classified under "deficits in nonverbal communicative behaviors used for social

interaction" and "deficits in social-emotional reciprocity" (Oregon Health & Science University, 2013). However, upon closer examination, this example was then classified under "deficits in developing and maintaining relationships appropriate to developmental level" (Oregon Health & Science University, 2013) as her facial expression and actions suggest an obvious discomfort and lack of a close relationship with her mom.

Removed ASD Behavior Example

Some examples of potential ASD behavior that were removed occurred during episode one when she first entered Nevermore Academy with her parents and met Principal Weems. From 8:43-9:41, this scene took place in Principal Weems' office while they were having a sit-down conversation regarding her enrollment in the school and therapy sessions. When Principal Weems talked about being roommates with Morticia Addams when they were both students, Wednesday replied, "And you graduated with your sanity intact? Impressive." (8:43) with a deadpan face but in an insolent tone. She continued with the rude remarks up until their conversation ended (9:41). While these examples were originally identified as deficits in verbal and nonverbal communicative behaviors (Oregon Health & Science University, 2013), a consideration of the context of the conversation made the researcher exclude these examples from the list of confirmed behaviors. Prior to this scene, Wednesday was notably upset and frustrated with her parents for having to move to a new school. With this insight, Wednesday Addams' behavior was attributed to being a reaction out of frustration rather than a deficit in verbal and nonverbal communicative behavior.

Potential ASD Behaviors vs. Confirmed ASD Behaviors: What Changed?

Examples include: nonverbal communicative behaviors decreased by nine from figure 1.1 to figure 2.1, meaning that nine examples were removed from this category; difficulty and deficits in maintaining relationships increased by two from figure 1.2 to figure 2.2, meaning that two examples were reclassified to this category; abnormal interests only decreased by one from figure 1.3 to figure 2.3, meaning that one example was removed from this category; lastly, there were hyper-reactivity to sensory input decreased by one from figure 1.4 to figure 2.4, meaning that another example was also removed. Changes were made to ensure data accuracy for the analysis and diagnosis. Such little change overall may imply that much of Wednesday's behavior satisfies the DSM-5 criteria for ASD and despite some examples that were removed from the data, she still qualifies for a positive ASD diagnosis.

ASD Behaviors were Frontloaded in Sample Episodes

Figure set 3 shows a plurality of ASD behaviors occurring within the first 10-minute block, from 00:00-9:59. The 55 behaviors within this block may suggest that the show sought to engage the audience for entertainment purposes, as previously mentioned. This approach may have been used to maintain and retain viewer engagement. Although this trend may be a random occurrence across the four episodes, such a possibility appears unlikely. While the researcher was unable to find any existing studies on the relationship between intentional techniques and strategies employed by television programs to captivate viewers' attention and minute-blocks, the researcher's observation provides valuable insights and could be worth future investigation.

Limitations

There are limitations that must be taken into consideration for this research. During the process of the literature review, the researcher was unable to access some articles and preliminary research, this may have led to the exclusion of relevant information and impacted the outcome of the study. Due to the restriction of time, the researcher was unable to perform the complete content analysis on all eight episodes of 'Wednesday' they had originally intended on conducting. This may have skewed the results to a less accurate diagnosis of the character as studies have shown that a positive diagnosis of ASD can take up to years to achieve (Crane et al., 2016). Additionally, this researcher is not a qualified professional and thus the analysis in this study was strictly done to the best of their abilities and should not be taken as a medical diagnosis.

Conclusion

This paper examines whether Netflix's 'Wednesday' portrays Wednesday Addams in a manner that satisfies the DSM-5 criteria for ASD. By performing a content analysis, the researcher analyzed possible examples of ASD behavior and determined that Wednesday satisfied the criteria for a positive diagnosis.

While content analysis has been used to analyze characters for psychiatric disorders (Aberle, 2021), this study is the first to utilize content analysis in conjunction with the DSM-5 criteria to assess Wednesday Addams. Although no similar studies were found during the conduct of this research, the popularity of Netflix's 'Wednesday' makes it likely that future research will follow. The show has provoked widespread public discussion on portrayals of ASD

in the media (Crimmins, 2023) despite the original creator of the Addams family and the showrunners of Netflix's 'Wednesday' having no intention of portraying her as being on the spectrum (Craig, 2022). Hence, this paper provides new insight into the accuracy of such discussion, filling a gap in research. This paper reviews the common stereotypes and stigma surrounding mental illness and highlights the importance for media creators to accurately represent mental illness due to the potentially harmful impact on those with mental illness and the role played in educating the general public to prevent misinterpreting and/or mislabeling.

Future research into this question should be conducted by a professional who can analyze the show in its entirety and avoid ambiguity to improve accuracy. Additionally, the researcher uncovered certain trends in the distribution of ASD behaviors that were not completely explored and therefore worthy of future investigation.

Work Cited

Aberle, A. (2021). *Mental illness representation in young adult literature*. UNI ScholarWorks. Retrieved March 27, 2023, from https://scholarworks.uni.edu/cgi/ viewcontent.cgi?article=2915&context=grp

Allen, H. (2016, October 20). *Bad Mothers and Monstrous Sons: Autistic Adults, Lifelong Dependency, and Sensationalized Narratives of Care*. SpringerLink. Retrieved February 16, 2023, from https://link.springer.com/article/10.1007/s10912-016-9406-4

Allen, R., & Nairn, R. G. (1997, June 31). *Media depictions of mental illness: An analysis of the use of dangerousness*. The Australian and New Zealand Journal of Psychiatry. Retrieved February 16, 2023, from https://pubmed.ncbi.nlm.nih.gov/9226083/

American Psychiatric Association. (2013). *DSM-5* . Psychiatry.org - DSM History. Retrieved January 27, 2023, from https://www.psychiatry.org/psychiatrists/practice/dsm/ about-dsm/history-of-the-dsm#:~:text=In%202007%2C%20APA%20formed%20the,5%2 0was%20published%20in%202013.

Angermeyer , M. C., & Matschinger, H. (1995). *Violent attacks on public figures by persons suffering from psychiatric disorders. Their effect on the social distance towards the mentally ill*. European archives of psychiatry and clinical neuroscience. Retrieved February 16, 2023, from https://pubmed.ncbi.nlm.nih.gov/7669823/

Angermeyer, M. C., & Dietrich, S. (2006, April). *Public Beliefs About and Attitudes Towards People with Mental Illness: A Review of Population Studies*. Research Gate. Retrieved February 16, 2023, from https://www.researchgate.net/publication/7308814_Public_ Beliefs_About_and_Attitudes_Towards_People_with_Mental_Illness_A_Review_of_Pop ulation_Studies

Associated Press. (2012, December 16). *Experts: No link between asperger's, violence*. USA Today. Retrieved February 16, 2023, from https://www.usatoday.com/story/news/nation /2012/12/16/sandy-hook-school-shooting-asperger-violence/1772589/

Baird, G., Pickles, A., Chandler, S., & Simonoff, E. (2006, August). *Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP)*. Research Gate. Retrieved February 16, 2023, from https://www.researchgate.net/publication/6942247_Prevalence_of_disorders_of_the_autis

m_spectrum_in_a_population_cohort_of_children_in_South_Thames_the_Special_Need s_and_Autism_Project_SNAP

Baron-Cohen, S. (2015, September 1). *Autism, maths, and sex: The special triangle*. The Lancet Psychiatry. Retrieved February 16, 2023, from https://www.thelancet.com/journals/lanpsy/ article/PIIS2215-0366(15)00397-1/fulltext

Belcher, C., & Maich, K. (2014). *Autism Spectrum Disorder in Popular Media: Storied Reflections of Societal Views*. Brock Education. Retrieved February 16, 2023, from https://files.eric.ed.gov/fulltext/EJ1057529.pdf

Bengtsson, M. (2016, February 17). *How to plan and perform a qualitative study using content analysis*. Elsevier. Retrieved March 21, 2023, from https://www.sciencedirect.com/ science/article/pii/S2352900816000029

Berryessa, C. M. (2014, February 24). *Judicial Perceptions of Media Portrayals of Offenders with High Functioning Autistic Spectrum Disorders*. International Journal of Criminology and Sociology. Retrieved February 16, 2023, from https://www.ncbi.nlm.nih.gov/pmc/ articles/PMC4338981/

Butler, J. R., & Hyler, S. E. (2005, July 14). *Hollywood portrayals of child and adolescent mental health treatment: implications for clinical practice*. Child and Adolescent Psychiatric Clinics of North America. Retrieved February 16, 2023, from https://pubmed.ncbi. nlm.nih.gov/15936671/

Butler, J. R., & Hyler, S. E. (2005, July). *Hollywood Portrayals of Child and Adolescent Mental Health Treatment: Implications for Clinical Practice*. Child and Adolescent Psychiatric Clinics of North America. Retrieved February 16, 2023, from https://www.childpsych.the clinics.com/article/S1056-4993(05)00028-3/fulltext#

Conn, R., & Bhugra, D. (2012, April). *The portrayal of autism in Hollywood films*. Research Gate. Retrieved February 16, 2023, from https://www.researchgate.net/publication /241714585_The_portrayal_of_autism_in_Hollywood_films

Corrigan, P. W., & Watson, A. C. (2002, February). *Understanding the impact of stigma on people with mental illness*. World Psychiatry: Official Journal of the World Psychiatric Association (WPA). Retrieved January 25, 2023, from https://www.ncbi.nlm.nih.gov /pmc/articles/PMC1489832/

Crane, L., Chester, J. W., Goddard, L., Henry, L. A., & Hill, E. L. (2015). *Experiences of autism diagnosis: A survey of over 1000 parents in the United Kingdom*. Retrieved March 21, 2023, from https://journals.sagepub.com/doi/pdf/10.1177/1362361315573636

Craig, J. (2022, November 28). *Is Wednesday Addams Autistic? Netflix Protagonist Explored*. ForeverGeek. Retrieved January 25, 2023, from https://www.forevergeek.com/is-wednesday-addams-autistic-netflix-protagonist-explored/

Crimmins, J. (2023, January 9). *Wednesday addams: Extraordinary personality or the Dark Triad? | healthnews*. healthnews. Retrieved January 25, 2023, from https://healthnews.com/family-health/healthy-living/wednesday-addams-extraordinary-personality-or-the-dark-triad/

Diefenbach, D. L., & West, M. (2007, March). *Television and attitudes toward mental health issues: Cultivation analysis and the third-person effect*. Journal of Community Psychology . Retrieved February 16, 2023, from https://www.researchgate.net/publication/229500416_Television_and_attitudes_toward_mental_health_issues_Cultivation_analysis_and_the_third-person_effect

Draaisma, D. (2009, June). *Stereotypes of autism*. Research Gate. Retrieved February 16, 2023, from https://www.researchgate.net/profile/Douwe-Draaisma-2/publication/26293558_Stereotypes_of_autism/links/551946cd0cf273292e711b08/Stereotypes-of-autism.pdf?origin=publication_detail

Fennell, D., & Boyd, M. (2014, May 23). *Obsessive-Compulsive Disorder in the Media*. Taylor & Francis Online. Retrieved February 16, 2023, from https://www.tandfonline.com/doi/abs/ 10.1080/01639625.2013.872526

Garner, A., Harwood, V., & Jones, S. C. (1970, January 1). *Discourses of Autism on Film: An Analysis of Memorable Images that Create Definition*. SpringerLink. Retrieved February 16, 2023, from https://link.springer.com/chapter/10.1057/9781137496850_9

Garner, A., Jones, S., & Harwood, V. (2015, February 2). *Authentic representations or stereotyped 'outliers': Using the CARS2 to assess film portrayals of autism spectrum disorders*. Taylor & Francis. Retrieved February 16, 2023, from https://www.tandfonline.com/doi/abs /10.1080/17542863.2015.1041993

Golstein, A., & Ressa, T. (2021, June). *Autism in Contemporary TV Shows: A Qualitative Study of the Impact of Educators Perceptions on Neurodiverse Learners*. International Journal of Humanities and Social Science. Retrieved February 16, 2023, from https://ijhssnet.com/journals/Vol_11_No_6_June_2021/1.pdf

Havermale, A. (2022, December 20). *'Wednesday' Continues to Top Netflix's Most-Watched List*. Collider. Retrieved January 25, 2023, from https://collider.com/wednesday-series-netflix-top-10-list/

Jones, S. C. (2022, November 29). *Hey look, I'm (not) on TV: autistic people reflect on autism portrayals in entertainment media*. Disability & Society. Retrieved March 21, 2023, from https://www.tandfonline.com/doi/abs/10.1080/09687599.2022.2150602?src=&journalCode=cdso20

Klin, A., & Lemish, D. (2008, July 13). *Mental disorders stigma in the media: Review of studies on production, content, and influences*. Journal of Health Communication. Retrieved February 16, 2023, from https://pubmed.ncbi.nlm.nih.gov/18661386/

Lee, J.-Y., & Deng, Z. (2020, March 6). *Atypical: A Novel Portrayal of Individuals With Autism Spectrum Disorder*. The Psychiatry Online. Retrieved February 16, 2023, from https://ajp.psychiatryonline.org/doi/10.1176/appi.ajp-rj.2020.150309

Macnamara, J. (2005, January). *Media Content Analysis: Its Uses, Benefits and Best Practice Methodology*. Asia Pacific Public Relations Journal. Retrieved March 21, 2023, from https://www.researchgate.net/publication/267387325_Media_Content_Analysis_Its_Uses_Benefits_and_Best_Practice_Methodology

Ma, Z. (2017). *How the media cover mental illnesses: A review - proquest*. ProQuest. Retrieved February 16, 2023, from https://www.proquest.com/docview/1854729282

Mayo Foundation for Medical Education and Research. (2022, December 13). *Mental illness*. Mayo Clinic. Retrieved January 27, 2023, from https://www.mayoclinic.org/diseases-conditions/mental-illness/symptoms-causes/syc-20374968#:~:text=Mental%20illness%2C%20also%20called%20mental,eating%20disorders%20and%20addictive%20behaviors.

Mayo Foundation for Medical Education and Research. (2018, January 6). *Autism spectrum disorder*. Mayo Clinic. Retrieved January 25, 2023, from https://www.mayoclinic.org/diseases-conditions/autism-spectrum-disorder/symptoms-causes/syc-20352928

McGinty, E. E., Webster, D. W., Jarlenski, M., & Barry, C. L. (2014, March). *News Media Framing of Serious Mental Illness and Gun Violence in the United States, 1997-2012*. American journal of public health. Retrieved February 16, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3953754/

Nordahl-Hansen, A. (2017, October 28). *Atypical: A typical portrayal of autism?* UiO DUO Research Archive. Retrieved February 16, 2023, from https://www.duo.uio.no/handle/10852/5908

Oregon Health & Science University. (2013, April 12). *DSM V Checklist* . Retrieved March 21, 2023, from https://www.ohsu.edu/sites/default/files/2019-02/DSM%20V%20Checklist.pdf

Parrott, S., & Parrott, C. T. (2015). *Law & disorder: The portrayal of mental illness in U.S. crime dramas*. American Psychological Association. Retrieved February 16, 2023, from https://psycnet.apa.org/record/2015-54636-006

Pirkis, J., Francis, C., Mccallum, K., & Blood, R. W. (2006, June). *On-Screen Portrayals of Mental Illness: Extent, Nature, and Impacts*. Journal of Health Communication. Retrieved February 16, 2023, from https://www.researchgate.net/publication/6938763_On-Screen_Portrayals_of_Mental_Illness_Extent_Nature_and_Impacts

Promoting Mental Health - World Health Organization. World Health Organization. (2004). Retrieved January 26, 2023, from https://apps.who.int/iris/bitstream/handle/10665/42940/9241591595.pdf

Prochnow, A. (2014, April). *An Analysis of Autism Through Media Representation*. JSTOR. Retrieved February 16, 2023, from https://www.jstor.org/stable/24761922?read-now=1

Reavley, N., & Jorm, A. F. (2010, May 4). *Prevention and early intervention to improve mental health in Higher Education Students: A Review*. Early Intervention in Psychiatry. Retrieved February 16, 2023, from https://pubmed.ncbi.nlm.nih.gov/20536969/

Ressa, T. (2021, August 3). *Histrionics of Autism in the Media and the Dangers of False Balance and False Identity on Neurotypical Viewers*. Brill. Retrieved February 16, 2023, from https://brill.com/view/journals/jdse/2/1/article-p1_1.xml#R000003

Ressa, T., & Goldstein, A. (2021, January). *Autism in contemporary TV shows: Perception of educators and impact on children with autism*. Research Gate. Retrieved February 16, 2023, from https://www.researchgate.net/profile/Theo_Ressa2/publication/358784670

_Autism_in_contemporary_TV_shows_Perception_of_educators_and_impact_on_childre
n_with_autism/links/624c6926cf60536e2343e197/Autism-in-contemporary-TV-shows-P
erception-of-educators-and-impact-on-children-with-autism.pdf?_sg%5B0%5D=started_
experiment_milestone&origin=journalDetail

Signorielli, N. (2009, May 18). *The stigma of mental illness on television*. Journal of
Broadcasting & Electronic Media . Retrieved February 16, 2023, from
https://www.tandfonline.com/ doi/abs/10.1080/08838158909364085

Smith, B. (2015). *Mental Illness Stigma in the Media*. Fisher Pub. Retrieved January 26, 2023,
from https://fisherpub.sjf.edu/cgi/viewcontent.cgi?article=1150&context=ur

Stinchfield, R., McCready , J., Turner, N. E., Jimenez-Murcia, S., Petry, N. M., Grant, J., Welte,
J., Chapman , H., & Winters, K. C. (2016, September). *Reliability, Validity, and
Classification Accuracy of the DSM-5 Diagnostic Criteria for Gambling Disorder and
Comparison to DSM-IV*. Retrieved March 21, 2023, from https://pubmed.ncbi.nlm.nih
.gov/26408026/

Stuart, H. (2006, February). *Media Portrayal of Mental Illness and Its Treatments: What Effect
Does It Have on People with Mental Illness?* Research Gate. Retrieved February 16,
2023, from https://www.researchgate.net/publication/7299322_Media_Portrayal_of_
Mental_Illness_and_Its_Treatments_What_Effect_Does_It_Have_on_People_with_Ment
al_Illness

Taylor, W. L. (2016, August 29). *Gauging the Mental Health Content of the Mass Media*. SAGE
Journals. Retrieved February 16, 2023, from https://journals.sagepub.com/doi/
abs/10.1177/107769905703400203

Varghese, A. M. (2021, October 23). *Neurodiversity through a lens: Television depictions of
autism spectrum disorder (ASD), perceptions of ASD, and prosociality toward the Autistic
Community*. eScholarship, University of California. Retrieved February 16, 2023, from
https://escholarship.org/uc/item/16t6d115

Wahl, O. F. (1992, October). *Mass media images of mental illness: A review of the literature*.
Wiley Online Library . Retrieved February 16, 2023, from
https://onlinelibrary.wiley.com/
doi/abs/10.1002/1520-6629%28199210%2920%3A4%3C343%3A%3AAID-JCOP22902
00408%3E3.0.CO%3B2-2

Wessely, S. (2012, April 28). *Anders Breivik, the public, and psychiatry*. The Lancet. Retrieved
February 16, 2023, from https://www.thelancet.com/journals/lancet/
article/PIIS0140-6736(12)60655-2/fulltext

Young, L. C. S. (2012, May). *Awareness with Accuracy: An Analysis of the Representation of
Autism in Film and Television*. OpenSIUC. Retrieved March 21, 2023, from https://core.
ac.uk/download/pdf/60541412.pdf

Zara, J. (2022, December 14). *How netflix's Wednesday became a pop culture phenomenon*. The
Guardian. Retrieved January 25, 2023, from https://www.theguardian.com/tv-and-radio
/2022/dec/14/wednesday-addams-family-reboot-netflix-tiktok

A Discussion of the Neurology of Romantic Love Across Sexes and Cultures By Heeseo Lee

Abstract

Romantic love is universal across all cultures and sexes, arising from neurological phenomena within the brain. The brain on love is a complex system, involving both the reward and motivation systems alongside hormones that interact to elicit ecstasy and therefore synthesize the feeling of being 'in love'. In this article, Heeseo Lee discusses the variability of neurobiology during phases of romantic attachment between sexes and across cultures, drawing ideas from the selective nature of evolution and how media and its consequent idea of gender roles can affect an individual in love. These topics connect together to form a more comprehensive picture of how different persons may respond to or think of romantic love. Results conclude that the two sexes differ in their processing of romantic data, displaying different cognitive evaluations of romantic stimuli, possibly due to different pressures placed on the two sexes throughout evolutionary history for survival. It may also be proposed that differences in social culture across races may correlate with one's expression of love in accordance with historical and culture-specific values, including media portrayals of romance and traditional ideas of how different genders should behave in a relationship. Studies have suggested that some of these differences in the way romantic love is expressed can be attributed to differences in brain activity in the posterior gland, the temporal lobe, and other cortical regions. However, romantic love is an extremely complex phenomena and requires further investigation to prove the correlation between cultures and sexes and romantic interest.

Introduction

When proposed with the thought of romantic love, most tend to think about the media portrayal of it—an extreme emotional and physical connection between two people caught in the throes of passion. However, this idealized viewpoint on love tends to come from Western media, excluding representations of how love may be expressed in other cultures (Karandashev). Romantic love is classified as a feeling of strong attraction for another person, and has deep correlations with sexual arousal. In many cases, media from different countries will portray different social understandings of love, influencing the manifestation of romantic love within that culture (Jankowiak and Fischer 55-149). Various researchers have explored this relationship

between culture and romantic love, both biologically and socially, and this domain of research will be further explored within this essay.

There also tends to be a difference in expectations for how sexes behave during love as well. Females are stereotypically thought to become 'clingy' and emotional while men are thought to exaggerate their qualities such as strength or intelligence in efforts to appear pleasing to their other half (Blackstone 335-338). Recent studies have proven that males and females do indeed not only activate different regions of the brain, but also differ in hormonal levels, as will be explored later on in this essay. Moreover, attitudes toward love tend to differ between sexes based on evolutionary history and an intrinsic need for evolutionary fitness (Buss and Schmitt 204-232). This tie between sociobiology and the differences in the expression of romantic love will be explored in further detail, alongside how traditional expectations for the roles of men and women in a romantic relationship has affected how the two genders function and process romantic relationships.

Love in Media

Historically, Western media and ideology has had a much larger presence in the world in comparison to other places, with East Asian influence having been more prominent in earlier ages. In the modern world this is not necessarily the case, but Western media still deigns to have incredible influence over the globe. In particular, media tends to portray extreme and unrealistic expectations of romance and romantic relationships, and can at times border on unhealthy (Conley and Ramsey 469-478).

Television, sit-coms, and dramas alike all idealize certain ideas of how a romantic relationship should look like and progress, and has rapidly changed how this is viewed by the world. In the 1980s, sexual intercourse before a marriage was highly looked down upon in the U.S., but on modern television, any romantic relationships are highly sexualized regardless of marital status or even age (Merritt 370). Underage sexual activity is encouraged through this medium, and unrealistic ideas on how this should progress through a relationship to reach a frankly unattainable level of emotional and sexual intimacy have affected large parts of the general population, especially youth who have grown up with this media (Merrit 370). Once people begin to see and believe these ideas portrayed in media, they begin to have unrealistic fantasies about how they wish their own love lives to look like. With these unrealistic

expectations, many people find that it is difficult to find or feel content in their relationships in the modern day, or accidentally put themselves in dangerous situations in an effort to recreate a romanticized television concept of how romantic love should look like.

In a highly globalized world connected by the internet, a person's culture and the media that they are exposed to may not be entirely the same. As such, even among people of the same culture or gender, expectations for behaviors during romantic relationships may not be the same and can vary greatly.

The Neuroscience of Love

The notion of romantic love from a scientific perspective can be broken down into three separate categories: lust, attraction, and attachment (Wu). Lust is associated with the hormones testosterone and estrogen in men and women respectively, and involves desire for sexual gratification. It arises from the primitive need to generate offspring in order to survive from an evolutionary perspective, but in modern society, expressions of sexual arousal can differ across cultures (Chen). Attachment is induced by the hormones arginine vasopressin (AVP) and oxytocin within the hypothalamus, which secrete from the posterior pituitary gland (Baribeau and Anagnostou 335). These hormones generate feelings of long-term fondness and devotion, which in many cases, can be confused with feelings of deep friendship or familial love.

Oxytocin (OT), more prevalent in women than men, is a pleiotropic hormone generally known for its influence on attachment between humans and its role in the process of childbirth. OT is high in both abundance and function, ranging from modulation of neuroendocrine reflexes to the regulation of complex social behaviors involved with reproduction (Gimpl and Fahrenholz 83-629). Due to its many uses in the human body, OT is one of many peptide hormones rooted in cellular mRNA, similar to another hormone involved in the brain in love: vasopressin.

Vasopressin (VP), in contrast to OT, supports behavior more tuned towards individual survival and is deeply related to the fear pathways, including mobilization and aggression. Much like OT, VP is a universal peptide molecule that affects various physiological functions, and is released and stored in the pituitary gland (Carter 356). Both hormones can be epigenetically adjusted by individual experiences of a subject. This can be seen in how VP can be expressed in trauma patients under extreme conditions, causing the V1aR receptor to dominate most of the body's responses and cause the individual to freeze cognitively, leading to what is most

commonly known as emotional dissociation (Carter 356). In love, current knowledge indicates that the OT and VP receptors are linked into an integrated system known as the OT-VP pathway. The presence of this pathway during romantic relationships involves reinforcement, attachment, and reward molecules, such as dopamine, and synthesizing intense emotions related to sexual and parental behavior (Hiller).

Meanwhile OT affects behaviors related to gonadotropin release, and therefore activity in the hypothalamus, pituitary gland, and gonads—the HPG axis (Jiang). These areas are known for affecting and synthesizing the sensation of love, and sensations of pleasure when in close contact with the object of affection. Studies have reported that women in love in particular show higher levels of gonadotropin and E2/T in the earlier stages of a romantic relationship, reflecting an increase in HPG axis activity (Sorokowski et al. 4224). This can lead to increases in activity in the ovaries and in estrogen synthesis, relating to fertility.

	Single Women (N = 69)			Women in Love (N = 47)			t (114)	P
	M	SD	Range	M	SD	Range		
E2 [pg/mL]	37.88	36.26	8.6–167.4	39.55	36.12	8.4–151.0	−0.41	0.68
fT [pg/mL]	1.21	0.73	0.3–3.5	0.92	0.59	0.3–3.1	2.52	0.01
E2/T	43.33	53.24	3.7–305.9	64.58	92.93	7.8–510.9	−1.90	0.06
PRL [ng/mL]	11.29	5.41	3.5–34.4	11.24	5.20	2.2–27.8	0.24	0.25
FSH [mi/mL]	6.71	2.44	1.2–15.4	7.55	2.35	3.7–13.7	−2.05	0.007
LH [mu/mL]	6.00	2.91	0.1–12.9	7.18	2.64	2.2–13.8	−2.39	<0.001
CT [ng/mL]	293.21	78.98	145.5–473.9	269.19	67.34	141.7–401.1	1.54	0.13
Age [years]	27.24	3.18	24–33	27.56	2.68	23–35	1.41	0.22
BMI [kg/m^2]	22.68	3.18	15.8–32.0	21.95	2.68	18.1–28.7	1.29	0.20

Table 1. Comparison of estradiol (E2, and E2/T), free testosterone (fT), prolactin (PRL), gonadotropin (FSH, LH), and cortisol (CT) levels between single women (N = 69) and women in love (N = 47). (Sorokowski et al. 4224).

Estrogens are a steroid/thyroid family of hormones consisting of nuclear receptors with countless variants. Estrogen signaling is commonly associated with gene activation based on changes in a cellular environment, and is most well known for its role in puberty for young women, such as regulation of the menstrual cycle (Marazziti and Canale 6-931). Released through the adrenal glands in female ovaries, estrogen levels can impact a subject's sexual desire and preparation for sexual intercourse. Similarly, while testosterone has little to no importance during romantic love in females, in males testosterone is highly linked with a subject's sexual

wants and needs (van Anders and Goldey 6-820). As such, sexual desire can play a large part in a subject's preference for a romantic partner and has relations to the brain in love.

Furthermore, prolactin (PRL), a hormone most commonly found during the process of lactation for babies, also plays a role in influencing social behavior during romantic love, and even the fertility of the subject. Released by the anterior pituitary gland, it can be found in the telencephalon, hippocampus, amygdala, sputum, the brain stem, and et cetera (Freeman et al. 631-1523). Due to its strong involvement in the process of creating offspring, it is theorized that proximity to a romantic partner and the resulting psychological and physiological responses may also trigger a boost in hormones such as PRL that are associated with fertility (Tritos and Klibanski 58-74).

Other than sexual responses, early stage romantic love is more heavily associated with specific physiological, psychological, and behavioral tendencies that have been noted by various researchers. These tendencies include euphoria, obsession and emotional dependency over the object of affection, a longing for a deep bond with the beloved, and an increase in mental energy (Burunat 1883-1910). Description of this intense emotion relates to the reward and motivation systems in order to win a specific partner. Studies have shown that romantic love involves the subcortical regions related to the reward systems such as the ventral tegmental area (VTA) and ventral striatum/nucleus accumbens (Aron et al. 37-327). This can be seen in Figure 1, through MRI scans showcasing the increase in activity in the VTA as romantic stimuli is input.
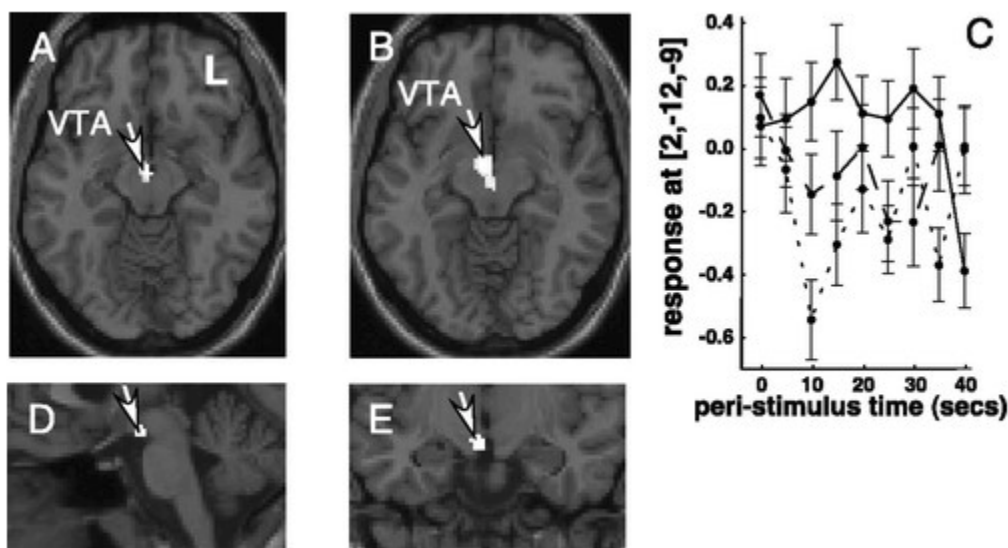
Figure 1. Group mean data and an individual subject show the localized ventral midbrain effect. *A*: positive-minus-neutral contrast. *B*: positive-minus-countback contrast. *C*: time-course of the BOLD response (means ± SE, 0 = mean of all conditions) for a voxel in the right VTA. *D*: in a single subject, a sagittal view shows the anteroposterior extent of the right VTA activation (arrow). *E*: in the same subject, a coronal view of the right VTA activation (arrow) shows how it is limited to the medial midbrain. (Aron et al. 37-327).

Several more studies indicate that activity in these regions during the process of romantic love can induce a drug-like effect in early stages of love through the production of dopamine, serotonin, and other reward hormones leading to symptoms of exhilaration, excessive energy, insomnia, and loss of appetite (Fisher et al. 58-62).

Interestingly, OT seems to play a large role in altering the human reward system to enhance the feeling of romantic love. A coupling between the vTS and dorsal-striatal (caudate nucleus) and meso-limbic (NAcc) areas occurs through the secretion of OT and causes an increase in desire for a particular partner's physical features or attractiveness through activation of various neural reward systems (Scheele et al.). This particular phenomenon is seen in humans and a surprisingly small number of mammalian species, all of whom exhibit monogamy, raising a highly possible correlation between this function of OT and the tendency towards monogamous relationships.

This combination of neural activity that increases in the cerebral cortex and subcortical regions also leads to a decrease in activity in the amygdala, which is a region of the brain associated with the criteria with which we can assess other people and their emotions and intentions (Zeki 9-2575). At the beginning phases of a relationship, high concentrations of dopamine create feelings of obsession, and regions of the brain associated with cognitive thinking and processing are deactivated (Aron et al. 37-327). Sexual arousal reduces activity in parts of the brain related to hierarchical critical thinking, self-awareness, and rational behavior. This neural activation highly overlaps with the brain activity seen during romantic love, highlighting the clear relationships between sexual arousal and romantic love (Shackelford).

An Evolutionary Perspective

As expected, the neuroscience of love is also heavily related to various hormones that have long-since been present in *Homo sapiens*. Powerful social bonds were essential to ancient *Homo sapiens* for their survival and reproduction, causing many adaptations towards ensuring successful reproduction (Sternberg 15-18). Some of these adaptations include ones that are commonly seen in natural mammal habitats, such as sexual selection. Oftentimes in mammals, females have much more high investment during reproduction in comparison to males due to the length of pregnancy and the comparative effort of childbirth. This causes them to select male partners much more selectively, which has carried over even into modern society (Andersson and Iwasa 53-38).

Fascinatingly, humans are part of a small evolutionary clade of mammals who practice social monogamy, in which a female and a male each only have one partner of the opposite sex at one time (Reichard and Boesch 12-20). A majority of mammals who practice monogamy, including humans, fall into a subgroup of monogamy labeled serial monogamy, in which it is most common to have several partners over a lifetime. Socially monogamous relationships can last a variable amount of time depending on the partners and the species. For example, many bird species will break pair relationships at the end of each breeding season and find new partners the following year, in comparison to humans, wherein relationships can last a far more variable length of time (Black and Hulme).

Contrary to the initial assumption of sexual exclusivity between romantic partners, recent studies have shown that sperm competition can play a prominent role in the choice of partnership in socially monogamous relationships (Firman and Simmons). This is due to the fact that in many cases, monogamous relationships have evolved to prioritize the successful reproduction of and higher survival rate of the offspring. This contributes to the fact that *Homo sapiens* fall under the Type I survivorship curve, in which all individuals of a species are expected to survive until maximum longevity is reached, thus making the maximum age of death and the mean life expectancy of an individual equal (Demetrius 4-213). Due to *Homo sapiens* being physiologically unable to produce many offspring at once, it is evolutionarily imperative that each offspring survive into adulthood. This has led to *Homo sapiens* adapting towards monogamous relationships in which male partners stay loyal to a female partner for longer

periods of time and are therefore able to better support and ensure the survival of their offspring (Reichard and Boesch 12-20).

Consequently, male and female roles in the domain of reproduction, supporting offspring, and romantic relationships have differed throughout evolutionary history, and are present even to this day (Klug 91-779).

Differences in Sex

In the context of sexes, males and females differ in many areas. One of these includes hormonal levels during romantic attraction. While both sexes rely on the presence of vasopressin and oxytocin during early phases of intense attraction, males tend to have overall higher concentrations of the former while females tend to have higher concentrations of the latter (de Boer et al. 24-114). Additionally, in females, oxytocin levels rise exponentially during orgasm while vasopressin levels, contrastingly, drop ("How Your Brain Falls in Love"). This, therefore, poses a hypothesis that women tend to develop stronger feelings of romantic love through or during sexual intercourse while men may fall in love during earlier stages of commitment without the presence of sexual arousal as vasopressin levels steadily increase during this phase.

Furthermore, men tend to rely more heavily on social cognition, processing, and emotion regulation through sensual input, while in contrast, women are more emotionally inclined and rely on visual input (Zeki 9-2575). This is why men tend to have higher brain activation in the insula, posterior cingulate cortex (PCC), which controls states of arousal and focus, and the prefrontal gyrus, which regulates thoughts and emotions, in comparison to females, displaying significantly different patterns of activation (Xiaomeng et al. 33-38). This evidence leads to there being different strategies between sexes when processing romantic stimuli. Men seem to rely more heavily on neural regions involved with processing social information in order to perceive and evaluate romantic love, and therefore tend to expend far more effort to evaluate romantic relationships (Zeki 9-2575). This is done through the usage of analytical thinking and justice-based evaluation. Women, on the other hand, are the opposite, with much more reliance on pure emotions and instinctual responses to those emotions through a sentimental and care-based standpoint (Yin).

The two sexes' attitudes on love also tend to differ. Previous studies classify love in six general attitudes: Eros (passionate), Ludus (game-playing), Storge (friendship), Pragma

(practical), Mania (possessive, dependent), and Agape (altruistic) (Lee). Eros has been identified by strong desires for and deep physical attraction to a partner. Erotic love is characterized by an emotionally deep and passionately expressive romantic relationship (Neto 54-239). Ludus is characteristic of a playful and game-like outlook on love, viewing a relationship much like a series of conquests or activities. This type of love is strongly associated with having multiple partners (Jonason). Storge is interpreted to be a relationship based on gradual affection and companionship, with common interest and trust achieved over time (Neto 54-239). Pragma is a highly practical outlook on romance, searching for a partner with common interests, background, and lifestyle (Davis). Mania is a type of obsessive love, and can be characterized by jealousy, exclusiveness, and insecurity (Jonason and Kavanagh 606-610). Agape can be identified by the want and need to place the other partner before oneself, and is considered extremely altruistic (Jonason and Kavanagh 606-610).

Research has reported that men tend to think of themselves as game-playing, searching for pleasure from a low-risk, low-stakes relationship, while women are more likely to choose friendship, practicality, and manic love (Henderick 392-402). Female pragmatism can be attested to female sexual selection, in which females desire partners with far more specific qualities than men, arising from a need for reproductive success due to their high investment in the reproductive process (Eastwick and Finkel 245-264). Studies show that when selecting a partner, females are more interested in income, intelligence, education, and self-confidence in comparison to males, who tend to focus more heavily on physical appearance in order to increase their probability of attracting a suitable mate (Buunk et al. 271-278). Despite this, however, patterns of these attitudes in regard to variables such as sexual attitudes and self-disclosure remain relatively similar between men and women.

As for sexual attitudes, studies have been fairly consistent in that women's attitudes towards sexual activity are far more conservative than that of males, showing men to report far more sexually permissive attitudes (Henderick 159-182). This male tendency has been suggested to be a result of a lack of risk when it comes to sexual activity, such as the process of fertilization and pregnancy (Crawford and Popp 13-26). Sexual intercourse is far more low-risk for men than women, causing females to display more caution in their attitudes. Other research along this vein has explored differences in gender expectations regarding premarital sexual behavior, which is more commonly referred to as the sexual 'double standard' (Henderick 55-65). In modern-day

society, research shows that premarital sexual activity is seen as more acceptable for men than for women, though this 'double standard' has shown a widespread decrease in recent decades.

Many scientists argue that this behavior in romantic relationships can be closely tied to sociobiological standards (Hrdy 14-309). For example, attitudes toward relationships and sexual activity are heavily tied to inherent instincts to ensure reproductive success. In order to achieve the highest possible evolutionary fitness, men would maximize their efforts to impregnate as many women as possible, while women would invest heavily in their infants and partners (Kenrick and Trost 59-100). These can provide intrinsic explanations for the Ludus outlook on love held by men in contrast to the Storage, Pragma, and Manic attitudes to love held by women, along with the societal 'double standard' that prevails even to this day.

From a more societal view, the social learning theory (Maisto et al. 106-163), and similar theories such as script theory (Gagnon and Simon 369), claim that men and women are rewarded by society for behaving in certain ways that are tied to traditional gender roles and concepts, and are contrastingly punished when they do not conform. These traditions can be deeply tied to cultural values and history, but the general trend across the globe and across history remain uncannily similar; men have a long-standing history of being strongly sexually active and permissive, and most times will hold all control in a romantic relationship, while women have historically been very passive, responsive, and more sexually guarded (Stearns). This has led to a variety of studies done on the relationship between culture, gender roles, and attitudes toward romantic love. Studies have shown a decisive trend supporting the tendency for men to develop the Ludus attitude toward love (Henderick 68-69). This may be due to the power dynamics between genders that is present in most cultures, with many countries promoting a patriarchal society that gives men more laid-back and powerful attitudes towards love and women. Similarly, others have argued that Mania, as it arises from strong personal feelings, is more independent of cultural factors, while Pragma, being a more logical process, would be more heavily affected by traditional values (Neto 626-635). These influences from social pressures may work together with previously mentioned evolutionary mindsets to form one's romantic mindset.

Gender Roles

        Gender roles have remarkable weight in society, and have been a large part of history. They are built upon the different expectations that are placed upon individuals based on their sex and on a society's beliefs about gender. They are a product of the interactions between an individual and their environment, and greatly affect how certain individuals may behave in social settings (Blackstone 335-338). Gender, often confused with the term "sex", refers to the meanings, values, and characteristics that people will expect of the different sexes (Deaux 49-81). In simpler terms, "sex" is a biological term defining a person's biological identity, while "gender" is a concept that has been created by humans to define the interactions between specific sexes and their surrounding social environments.

        Traditionally, many Western societies have had a conception that women are more nurturing than men due to their biological role in bearing children. This has led to a traditional view of a feminine gender role that ascertains that women should behave in ways that will make them more nurturing, such as appearing, acting, and sounding soft, submissive, gentle, and the such (Eisend 72-80). This stereotype has led to a long history of women being delegated to house work in contrast to men, who were expected to work outside of the home to support their families. Men have traditionally been expected to take on leadership roles, and prove themselves to be physically and mentally "stronger" than their female counterparts, both in the home and in society. Throughout history, men have therefore been the heads of their households and provided for their families financially and through making important decisions, cementing a masculine gender role. This has led to the rise of many common sayings that hold a lot of weight, such as "be a man" (Eisler and Blalock 45-60).

        Gender roles and expectations for men and women have fluctuated greatly throughout history as events changed the way that society viewed the stereotypical "roles" of the two genders. From an evolutionary perspective, some scientists have theorized that psychological dispositions regarding gender roles may rise from the different challenges that males and females face during the mating process (Buss and Schmitt 204-232). For example, competition between males may lead to a disposition for aggression and risk-taking, while sexual selection of protective males to ensure the safety of their offspring may cause females to stray towards a more dependent and risk-avoidant disposition (Bailey 266-267).

As such, the two sexes often find themselves held in highly different regard in traditional societies. Throughout history, depending on different cultures, a wide variation of gender roles and expectations have been seen. For example, in Tchambuli culture, men are dependent, flirtatious, concerned with their appearance, and take great interest in the arts ("Sociology Reference Guide"). In contrast, all of these traits are more commonly associated with the feminine gender roles in traditional Western society. Tchambuli women, meanwhile, are expected to do the fishing and manufacturing ("Sociology Reference Guide"). This gives them the power over the economic life of the community, which is associated with a masculine gender role in the Western world. As such, it can be said that culture, socialization, and media play increasingly large roles in gender role acquisition.

Socialization is the process in which individuals begin to learn what society has deemed "acceptable" or "unacceptable" and choose between the two in a manner that will help them conform to what is expected of them (Maccoby et al. 3-35). This begins almost immediately after birth, and is greatly affected by the different environments of different cultures. In general, however, females are taught to engage in more expressive pursuits in contrast to more physical or leadership-oriented roles, while males are encouraged to engage in more goal-oriented and emotion-strict behaviors (Blackstone 335-338). This is further reinforced through society through the introduction of certain expectations for males and females respectively. This includes gender specific toys such as sports equipment in contrast to dolls, and gender-specific clothing, such as pants in contrast to skirts or dresses (Blackstone 335-338).

Historically, this kind of separation between genders and their expected roles have caused large problems, especially for women. Women are often portrayed in the media as highly sexualized, more passive, and have taken on smaller roles than males (Conley and Ramsey 469-478). Since the late 1970s, women have also begun to be portrayed in popular Western media in increasingly thin images emphasizing unrealistic beauty standards. This includes magazines, beauty contests, models, and pop culture. In Figure 2, it can be seen that the WHR, or waist-hip ratio of playboy centerfold models, or in simpler terms, "nude models", increases drastically from 1970, edging uncomfortably close to the "health risk" categorization of above 0.80. This presence of an ideal thin body has led to an increasing trend of body dissatisfaction among women, leading to a sharp rise in eating disorders in past years (Mazur 281-303).
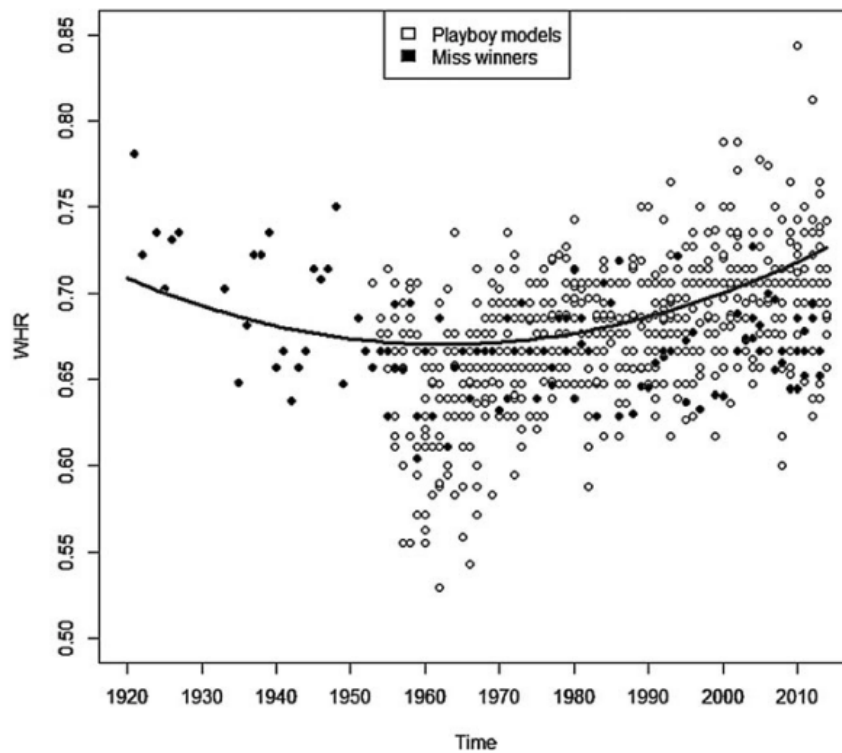
Figure 2. WHR values for playboy centerfold models (in white) and winners of 4 Miss pageants (Miss America, Miss World, Miss Earth, and Miss Universe, in black) by time of magazine appearance or victory. (Mazur 339).

This can also be seen in one of the most influential media outlets in the world, which began in 1937: Disney. Classic Disney princesses perpetuate stereotypical gender roles by being thin, graceful, young, submissive, and attractive (Johnson). Moreover, they tend to require a handsome young suitor of the opposite sex to come rescue them from peril. The earliest of princesses, including Snow White, Cinderella, and Sleeping Beauty, personify submissiveness and other traditional feminine gender roles (Johnson). Over the years, Disney has gradually shifted with societal norms to produce princesses that have showcased more heroic, athletic, and stereotypically masculine gender roles, but many problems still remain, including the extremely high beauty standards and ridiculous thinness to princess' bodies.

Media exposure plays an imperative role in the process of socialization of young children, who are more sensitive to messages regarding their role in society due to their emerging cognitive and social development (Agarwal & Dhanasekaran 38-45). Media, therefore, plays a

large role in teaching children what is socially acceptable and many times will perpetuate sociocultural norms. Due to the large consumption of media regarding gender expectations, several studies have found negative correlations between media consumption and lower personal contentment in young children (Agarwal & Dhanasekaran 38-45). A high proportion of children in this category have proven to be females, who are more vulnerable due to the objectification of women in media, leading to a lower self-esteem and body satisfaction starting from a young age (Clay and Dittmar 451-477). This body dissatisfaction has been related to many mental health issues including depression, low self-esteem, eating disorders, and obesity, and has remained one of the core aspects affecting womens' overall mental and physical health (Grabe and Hyde 2840-2858). While extreme portrayals of the stereotypical feminine and masculine gender roles have slowly dispersed in modern day society, body image and expectations remain a large problem.

In romantic relationships, gender roles can be perpetuated by societal expectations across cultures. Many societies and cultures have varying views on what these specific behaviors of a man or woman in a relationship will look like. In many cases, women are still expected, to an extent, to provide affection and emotional support, caring for the home by foregoing independent achievement, while men will seek individual and financial success by foregoing closer relationships with family or friends (Cancian). While this viewpoint is now seen as a more extreme traditional stereotype, gender roles still remain a prevalent and serious problem in modern day society.

Differences in Culture

From a neurological standpoint, the representation of romantic love within the brain is the same across cultures (Jankowiak and Fischer 55-149). Core regions of the brain that modulate romantic love, such as the subcortical regions, the hypothalamus, and the systems involved with dopaminergic cells are seemingly identical across all homo sapiens. Although there are conflicting and controversial studies on differences in neural activation during the earlier phases of romantic love based on culture, this is most likely attributed to variable inaccuracy, leaving love to be a universal rooted in the basic evolutionary system. Despite being neurologically identical, the manifestation of romantic love as a social concept and as portrayed through behavior seems to differ greatly depending on the culture involved (Hatfield and Rapson).

Different traditional values greatly impact peoples' definitions of romantic love and thus the way that they will think, feel, and behave in romantic settings.

Cultural values influence the way that love is expressed and the correlation between romantic love and sexual attraction. It is theorized that a cultural perspective may be more powerful than evolutionary heritage when understanding complex relationships and attraction between lovers due to how deeply rooted romance is within culture (Karandashev). For example, the following words are one of the most well-known internationally, even excluding political barriers: *love* (English), *amor* (Spanish), *amour* (French), *amore* (Italian), *liebe* (German).

Euro-American culture and media tend to dictate self-interest and autonomy in romantic love. In contrast, collectivist cultures such as those in East Asia tend to place more emphasis on the group as a whole—whether that be societal or familial—with romantic interest placed after (Dion and Dion 5-17). This is heavily based on tradition and history.

Approximately 1,000 years ago, in the Late Shang Dynasty of China, as Neo-Confucianists gained political and religious power, Chinese and later on East Asian perspectives regarding love gradually altered and became more severe (Murstein 469). Erotic art and literature were most often burned, and due to intermarriage customs, it mattered very little whether or not spouses were sexually or romantically attracted to one another. Concubines were also widely popularized, weakening the link between sexual attraction and romantic ideals (Murstein 475-476). After the People's Republic of China was established in 1949 and Communism became widespread, romantic love and supposedly inappropriate sexual activity became heavily criticized. Romantic love was completely disregarded and was described as a "psychosomatic activity that consumed energy and wastes time" (Murstein 482).

While in the modern day, this extreme viewpoint has become far less emphasized, culture has a very large impact on how many go about their lives, including in romantic ventures. Confucianist values emphasize familial ties above all else, and in many cases, East Asians are still very conservative about showing romance in public and regarding explicit sexual activity (Zabin et al. 1-12). Several studies have proved that more conservative societies such as that of China report far lower levels of sexual experience and frequency of sexual behaviors, alongside much fewer lifetime partners in comparison to Euro-American or Hispanic peoples (Meston and Ahrold 89-179).

	Men			Women			Gender		Ethnicity		Ethnicity × Gender	
N: Item	Euro-American 209 % Yes	Hispanic 47 % Yes	Asian 49 % Yes	Euro-American 578 % Yes	Hispanic 123 % Yes	Asian 123 % Yes	$\chi^{2\ a}$	Φ^{b}	χ^2	Φ	χ^2	Φ
Petting[c]	97	98	91	97	97	89	.11	.01	19.47***	.13	1.89	.01
Oral sex[c]	91	93	67	91	89	81	.42	.02	27.83***	.16	35.55***	.18
Intercourse[c]	73	73	49	76	71	66	1.64	.04	15.05**	.11	2.78**	.14
Masturbation	97	93	89	68	60	60	107.20***	.29	5.92	.07	1.45	.01

[a] Pearson's χ^2

[b] Nominal Φ (effect size)

[c] Score indicates endorsement of one or more items within sexual behavior subscale

** $p < .0025$ (.01/4 comparisons); *** $p < .00025$

Table 2. DSFI Sexual Experience subscales by ethnicity and gender. (Meston and Ahrold 183).

Contrastingly, European attitudes towards love have been historically much more positive. Christianity emphasizes love as self-sacrificial and unselfish, highlighting harmony and peace between two peoples. Sexual attraction was not highly regarded until the 13th century when the terms affection and amor were first created (Kalyuga 76). As time went on, English literature gradually became far more fascinated with the concept of romantic love and the topic became widely discussed. Synonyms for feelings of love grew exponentially during the 14th century. With the birth of Shakespeare and a consequent sharp increase in interest in romantic tragedy, love was described as an all-consuming passion and supposedly impossible to resist (Mulready). Romantic love has since then developed but has played large roles in shaping European society. Concepts such as romanticism gained many followers, and following the sexual revolution in the late 1900s, sexual attraction has since then been highly romanticized in Western media (Cover 53-72).

In the modern day, romance is idealized in Western societies such as the United States, which scientists have found, perplexingly, to be a merely Western phenomenon (Karandeshev). Concepts such as 'soulmates', a 'hero rescuing a princess', and 'star-crossed lovers' are common ideas in media, with over-sexualization being a large issue debated by many living in Western societies. As such, romantic love is more commonplace and idealized in individualistic cultures while it tends to be less valued in collectivistic cultures with a stronger emphasis on family ties (Karandeshev).

However, this can also be contrasted with the idea that individualism itself may interfere with romantic relationships, thus forming the perception of a less rewarding and deep

relationship between partners (Karandeshev). In collectivistic cultures, there is a high level of dependency between all peoples, leading to closer ties that encourage pragmatic and altruistic goals supported by mutual friendship and belonging.

Conclusion

Romantic love is a concept that has been pondered upon and wondered about ever since the earliest moments of time. The earliest love poem dates back to ancient Mesopotamia, in 2000 BCE, composed as a biblical Song of Songs (Mark). Over the years, various people of historical relevance, including Aristotle, Immanuel Kant, John Locke, and others have all reminisced about what love truly means to the human soul, and just how mystical and powerful of a thing it is. Of course, when it all comes down to it, romantic love can be summarized as mere biological phenomena in the brain, initially evolved from a primitive desire to leave behind offspring to survive in nature (Reichard and Boesch 12-20). However, as humans have evolved, more and more variability has changed the course of how human love can be seen and portrayed. Sex, environment, experience, history, culture, and even more can all influence how romantic love is expressed by and experienced in people all across the world.

In the media, love has become both highly romanticized and sexualized, which has affected the development of gender roles and expectations for young children, especially women. These stereotypes for how each gender should behave in love can have large effects in how individuals may behave in their relationships. These behaviors can also differ across cultures, perhaps even more so than any differences in neurobiology that may come from differing sexes. Collectivistic and individualistic cultures have reported different levels of intimacy, dependency, and tendencies towards types of love, which can vary depending on the environment and ideas that an individual is exposed to. From a more neurological perspective, neural pathways such as the reward and motivation systems can differ across genders, both in hormone activation and cognitive processing of relationships, therefore affecting how males and females fall in love and may behave during a relationship. These differences have been theorized to have arisen from evolutionary history due to the different selective pressures placed upon males and females for survival in past history.

Ultimately, it can be said that love is universal. However, due to a wide variety of factors, the feeling of romantic love can also be a highly personal and individual experience that cannot

quite be replicated per person—differing across cultures, genders, and media exposure. Furthermore, there are many things that still remain unknown on this topic despite the large amount of research that has already been conducted. It seems as though there will always be more to be discovered.

Works Cited

Agarwal, Vivek, and Saranya Dhanasekaran. "Harmful effects of media on children and adolescents." *Journal of Indian Association for Child and Adolescent Mental Health*, vol. 8, no. 2, 2012, pp. 38-45. https://doi.org/10.1177/0973134220120201

Andersson, Malte, and Yoh Iwasa. "Sexual selection." *Trends in Ecology & Evolution*, vol. 11, no. 2, 1996, pp. 53-38. https://doi.org/10.1016/0169-5347(96)81042-1

Aron, Arthur, et al. "Reward, motivation, and emotion systems associated with early-stage intense romantic love." *Journal of Neurophysiology,* vol. 94, no. 1, 2005, pp. 327-37. https://doi.org/10.1152/jn.00838.2004

Bailey, Drew H., et al. "Ultimate and Proximate Influences on Human Sex Differences." *Behavioral and Brain Sciences*, vol. 32, no. 3-4, 2009, pp. 266–267. https://doi.org/10.1017/S0140525X09990483.

Baribeau, Danielle A., and Evdokia Anagnostou. "Oxytocin and vasopressin: linking pituitary neuropeptides and their receptors to social neurocircuits." *Frontiers in neuroscience,* vol. 9, 2015, pp. 335. https://doi.org/10.3389/fnins.2015.00335

Black, Jeffrey, and Mark Hulme. *Partnerships in Birds: The Study of Monogamy*. Oxford University Press, 1996.

Blackstone, Amy. "Gender Roles and Society." *Human Ecology: An Encyclopedia of Children, Families, Communities, and Environments,* 2003, pp. 335-338. *University of Maine.*

Burunat, Enrique. "Love Is Not an Emotion." *Psychology*, vol. 7, 2016, pp. 1883-1910. https://doi.org/10.4236/psych.2016.714173.

Buss, David M., and David P. Schmitt. "Sexual Strategies Theory: An evolutionary perspective on human mating." *Psychological Review,* vol. 100, no. 2, 1993, pp. 204–232. https://doi.org/10.1037/0033-295X.100.2.204

Buunk, Bram P., et al. "Age and Gender Differences in Mate Selection Criteria for Various Involvement Levels." Personal Relationships, vol. 9, no. 3, 2002, pp. 271-278. https://doi.org/10.1111/1475-6811.00018

Cancian, Francesca M.. *Love in America: Gender and self-development.* Cambridge University Press, 1987.

Carter, Sue C.. "The Oxytocin-Vasopressin Pathway in the Context of Love and Fear."

Frontiers in Endocrinology, vol. 8, 2017, pp. 356. https://doi.org/10.3389/fendo. 2017.00356

Chen, Chaona. "Distinct facial expressions represent pain and pleasure across cultures." *Proceedings of the National Academy of Sciences*, vol. 115, no. 43, 2018. https://doi.org/10.1073/pnas.1807862115

Clay, Vignoles, and Helga Dittmar. "Body image and self-esteem among adolescent girls: Testing the influence of sociocultural factors." *Journal of Research on Adolescence*, vol. 15, no. 4, 2005, pp. 451-477. http://doi.org/10.1111/j.1532-7795.2005.00107.x

Conley, Terri D., and Laura R. Ramsey. "Killing Us Softly? Investigating Portrayals of Women and Men in Contemporary Magazine Advertisements." *Psychology of Women Quarterly,* vol. 35, no. 3, 2011, pp. 469–478. https://doi.org/10.1177/036168431 1413383

Cover, Rob. "The Naked Subject: Nudity, Context and Sexualization in Contemporary Culture." *Body & Society*, vol. 9, no. 3, 2003, pp. 53–72. https://doi.org/10.1177 /1357034X030093004

Crawford, Mary, and Danielle Popp. "Sexual double standards: A review and methodological critique of two decades of research." The Journal of Sex Research, vol. 40, no. 1, 2003, pp. 13-26. https://doi.org/10.1080/00224490309552163

Davis, Keith E.. "Love Styles and Relationship Quality: A Contribution to Validation." *Journal of Social and Personal Relationships*, vol. 4, no. 4, 1987. https://doi.org/10.1177/0265407587044

de Boer, A., et al. "Love is more than just a kiss: a neurobiological perspective on love and affection." *Neuroscience* vol. 201, 2012, pp. 114-24. https://doi.org/10.10 16/j.neuroscience.2011.11.017

Deaux, Kay. "Sex and Gender." *Annual Review of Psychology*, vol. 36, 1985, pp. 49-81. https://doi.org/10.1146/annurev.ps.36.020185.000405

Demetrius, Lloyd. "Adaptive value, entropy and survivorship curves." *Nature,* vol. 275, no. 5677, 1978, pp. 213-4. https://doi.org/10.1038/275213a0

Dion, Karen K., and Kenneth L. Dion. "Cultural perspectives on romantic love." *Personal Relationships*, vol. 3, no. 1, 1996, pp. 5-17. https://doi.org/10.1111/j.1475-6811. 1996.tb00101.x

Eastwick, Paul W., and Eli J. Finkel. "Sex differences in mate preferences revisited: Do people know what they initially desire in a romantic partner?" *Journal of Personality and Social Psychology*, vol. 94, no. 2, 2008, pp. 245-264. https://doi.org/10.1037/0 022-3514.94.2.245

Eisend, Martin. "Gender Roles." Journal of Advertising, vol. 48, no. 1, 2019, pp. 72-80. https://doi.org/10.1080/00913367.2019.1566103

Eisler, Richard M., and Janice A. Blalock. "Masculine gender role stress: Implications for the assessment of men." Clinical Psychology Review, vol. 11, no. 1, 1991, pp. 45-60. https://doi.org/10.1016/0272-7358(91)90137-J

Firman, Renée C. and Leigh W. Simmons. "Experimental evolution of sperm competitiveness in a mammal." *BMC Evol Biol*, vol. 11, no. 19, 2011. https://doi.org /10.1186/1471-2148-11-19

Fisher, Helen, et al. "Romantic love: an fMRI study of a neural mechanism for mate choice." *The Journal of Comparative Neurology,* vol. 493, no. 1, 2005, pp. 58-62. aron

Freeman, Marc E., et al. "Prolactin: structure, function, and regulation of secretion." *Physiological Reviews,* vol. 80, no. 4 , 2000, pp. 1523-631. https://doi.org/10. 1152/physrev.2000.80.4.1523

Gagnon, John H., and William Simon. *Sexual Conduct: The Social Sources of Human Sexuality.* 2 ed., Routledge, 1973, pp. 369. https://doi.org/10.4324/9781315129242

Gimpl, Gerald, and Falk Farenholtz . "The oxytocin receptor system: structure, function, and regulation." *Physiological Reviews,* vol. 81, no. 2, 2001, pp. 629-83. https://doi.org/ 10.1152/physrev.2001.81.2.629

Grabe, Shelley, and Janet S. Hyde. "Body objectification, MTV, and psychological outcomes among female adolescents." *Journal of Applied Social Psychology*, vol. 39, no. 12, 2009, pp. 2840-2858. https://doi.org/10.1111/j.1559-1816.2009.00552.x

Hatfield, Elaine, and Richard L. Rapson. *Love and sex: Cross-cultural perspectives.* University Press of America, 1996.

Henderick, Clyde, and Susan Henderick. "A theory and method of love." *Journal of Personality and Social Psychology*, vol. 50, no. 2, 1986, pp. 392-402. https://doi.org/10.1037/0022-3514.50.2.392

Henderick, Clyde, and Susan Henderick. "Gender differences and similarities in sex and love." *Personal Relationships*, vol. 2, no. 1, 1995, pp. 55-65. https://doi.org/10.1111/j. 1475-6811.1995.tb00077.x

Henderick, Clyde, and Susan Henderick. "Romantic Love." *Journal of Community & Applied Social Psychology*, vol. 5, no. 1, 1995, pp. 68-69. https://doi.org/10.1002 /casp.2450050107

Henderick, Clyde, and Susan Henderick. "Sex and Romantic Love: Connects and Disconnects." *The handbook of sexuality in close relationships*, 2004, pp. 159-182.

Hiller, Janice. "Speculations on the links between feelings, emotions and sexual behaviour: Are vasopressin and oxytocin involved?", *Sexual and Relationship Therapy,* vol. 19, no. 4, 2010. https://doi.org/10.1080/14681990412331297974

"How Your Brain Falls In Love | Dawn Maslar | TEDxBocaRaton." *YouTube*, YouTube, 6 July 2016, www.youtube.com/watch?v=eyq2Wo4eUDg.

Hrdy, Sarah B.. "The Evolution of Human Sexuality: The Latest Word and the Last." *The Quarterly Review of Biology*, vol. 54, no. 3, 1979, pp. 14-309. *JSTOR*, http://www.jstor.org/stable/2825810.

Jankowiak, William R., and Edward F. Fischer. "A Cross-Cultural Perspective on Romantic Love." *Ethnology*, vol. 31, no. 2, 1992, pp. 149–55. *JSTOR*, https://doi.org/10. 2307/3773618.

Jiang, Jinging, et al. "Recognition of Gonadal Development in Eriocheir sinensis Based on the Impulse of Love at First Sight." *Frontiers in Physiology*, vol 13, 2022. https://doi.org/10.3389/fphys.2022.793699.

Johnson, Rachael M.. "The evolution of Disney princesses and their effect on body image, gender roles, and the portrayal of love." *Educational Specialist,* vol. 6, 2015. https://commons.lib.jmu.edu/edspec201019/6

Jonason, Peter K., and Philip Kavanagh. "The dark side of love: Love styles and the Dark Triad." Personality and Individual Differenes, vol. 49, no. 6, 2010, pp. 606-610. https://doi.org/10.1016/j.paid.2010.05.030

Jonason, Peter K., et al. "The *mania* and *ludus* love styles are central to pathological personality traits." Personality and Individual Differences, vol. 165, 2020. https://doi.org/10.1016/j.paid.2020.110159

Kalyuga, Marika. "Vocabulary of love." *The Psychology of Love*, vol. 3, 2012, pp. 75-87.

Karandashev, Victor. "A Cultural Perspective on Romantic Love." *Online Readings in Psychology and Culture*. June. 2015, https://doi.org/10.9707/2307-0919.1135

Kenrick, Douglas T., and Melanie R. Trost. "A biosocial theory of heterosexual relationships." *Females, males, and sexuality: Theories and research*, pp. 59–100. *State University of New York Press.*

Klug, Hope, et al. "The origin of parental care in relation to male and female life history." *Ecology and Evolution,* vol. 3, no. 4, 2013, pp. 779-91. https://doi.org/10.1002/ece3.493

Lee, John A.. *Colours of love: An exploration of the ways of loving.* 1 ed., New Press, 1973.

Maccoby, Eleanor E, et al. *Handbook of Socialization: Theory and Research.* 2nd ed., New York, The Guilford Press, 2015, pp. 3-35.

Maisto, Stephen A., et al. "Social learning theory." *Psychological theories of drinking and alcoholism,* 1999, pp. 106–163. *The Guilford Press.*

Marazziti, Donatella, and Domenico Canale. "Hormonal changes when falling in love." *Psychoneuroendocrinology,* vol. 29, no. 7, 2004, pp. 931-6. https://doi.org/10.1016/j.psyneuen.2003.08.006

Mark, Joshua J.. "The World's Oldest Love Poem." *World History Encyclopedia*. World History Encyclopedia, 13 Aug 2014.

Mazur, Allan. "U.S. trends in feminine beauty and overadaptation." The Journal of Sex Research, vol. 22, no. 3, 1986, pp. 281-303. https://doi.org/10.1080/00224498609551309

Merritt, Tonoah P.. "How T.V. Promotes an Unrealistic Image of Romantic Relationships." *All Capstone Projects*, 2010, pp. 370. https://opus.govst.edu/capstones/370

Meston, Cindy M., and Tierney Ahrold. "Ethnic, gender, and acculturation influences on sexual behaviors." *Archives of sexual behavior* vol. 39, no. 1, 2010, pp. 89-179. https://doi.org/10.1007/s10508-008-9415-0

Mulready, Cyrus. *Romance on the Early Modern Stage: English Expansion Before and After Shakespeare.* London, Palgrave Macmillan, 2013.

Murstein, Bernard I.. *Love, sex, and marriage through the ages.* New York, Springer, 1974, pp. 469-475.

Neto, Félix, et al. "Cross-Cultural Variations in Attitudes Toward Love." *Journal of Cross-Cultural Psychology*, vol. 31, 2000, pp. 626-635. https://doi.org/10.1177/00 22022100031005005

Neto, Félix. "Love Styles: A Cross-Cultural Study of British, Indian, and Portuguese College Students." *Journal of Comparative Family Studies*, vol. 38, no. 2, 2007, pp. 239–54. *JSTOR*, http://www.jstor.org/stable/41604144.

Reichard, Ulrich, and Christophe Boesch. *Monogamy: Mating Strategies and Partnerships in Birds, Humans and Other Mammals*. Cambridge University Press, 2003, pp. 12-20.

Scheele, Dirk, et al. "Oxytocin alters the human reward system to maintain romantic love." *Pharmacopsychiatry,* vol. 46, no. 6, 2013. https://doi.org/10.1055/s-0033-1353354

Shackelford, Todd K., editor. *The Cambridge Handbook of Evolutionary Perspectives on Sexual Psychology*, vol. 3, Cambridge University Press, 2022.

Sociology Reference Guide: Gender Roles & Equality. Hackensack, Salem Press, 2011.

Sorokowski, Piotr, et al. "Romantic Love and Reproductive Hormones in Women." *International Journal of Environmental Research and Public Health,* vol. 16, no. 21, 2019, pp. 4224. https://doi.org/10.3390/ijerph16214224

Stearns, Peter N.. *Gender in World History*. 3 ed., Routledge, 2015. https://doi.org/10 .4324/9781315722276

Sternberg, Robert J.. *The new psychology of love*. Yale University Press, 2006, pp. 15-18.

Tritos, Nicholas A., and Anne Klibanski. "Prolactin And Its Role In Human Reproduction." *Yen And Jaffe's Reproductive Endocrinology*, 8th ed., Elsevier, 2019, pp. 58-74. https://doi.org/10.1016/b978-0-323-47912-7.00003-2.

van Anders, Sari M., and Katherine L Goldey. "Testosterone and partnering are linked via relationship status for women and 'relationship orientation' for men." Hormones and Behavior, vol. 58, no. 5, 2010, pp. 820-6. https://doi.org/10.1016/j.yhbeh. 2010.08.005

Wu, Katherine. "Love, Actually: The science behind lust, attraction, and companionship." *Science in The News*, Harvard University, 14 Feb. 2017, sitn.hms.harvard.edu/flash/ 2017/love-actually-science-behind-lust-attraction-companionship/.

Xiaomeng, Xu, et al. "Regional brain activity during early-stage intense romantic love predicted relationship outcomes after 40 months: An fMRI assessment."

Neuroscience Letters, vol. 526, no. 1, 2012, pp. 33-38. https://doi.org/10.1016/j
.neulet.2012.08.004

Yin, Jie, et al. "Cognition, emotion and reward networks associated with sex differences for
romantic appraisals." *Scientific reports,* vol. 8, no. 1, 2018, pp. 2835. https://doi.org
/10.1038/s41598-018-21079-5

Zabin, Laurie S., et al. "Levels of Change in Adolescent Sexual Behavior in Three Asian
Cities." Studies in Family Planning, vol. 40, no. 1, 2009, pp. 1-12. https://doi
.org/10.1111/j.1728-4465.2009.00182.x

Zeki, Semir. "The neurobiology of love." *FEBS letters,* vol. 581, no. 14, 2007, pp. 2575-9.
https://doi.org/10.1016/j.febslet.2007.03.094

Implementation of Positive Psychology in Korean Education By Yoonjin Kwon

Abstract

Many Korean students fail to experience well-being because of the intense pressure to succeed, which leads to the lack of risk-taking or variability in South Korea. About one-third of middle and high school students in South Korea has considered committing suicide; more than half have claimed that academics cause more stress than any other factor in their lives. Since the midst of South Korea's development, Koreans considered education as a gateway for them to escape poverty; juxtaposed with Confucius beliefs, the idea of education has developed into a concept that is worth competing and fighting for. As a possible approach to the impact of the excessive educational pressure in Korea, this research examines how Positive Psychology can be implemented into the teachers' lesson plans in order to alleviate the tense environment. The purpose of positive psychology is to make people stronger and more productive, which ultimately creates high human potential. The research was designed to test two hypotheses: the first hypothesis is utilizing group discussions in daily lessons in order to allow students to input their thoughts and potentially experience failure by being challenged to think of other thoughts; the second is the stronger emphasis on the overall process. Stronger emphasis on process provides room for improvement. This can be seen through providing various styles of assessments and assignments, and active feedback. Through these processes, students develop resilience which is the main factor to gain sustainable-well-being. Through case studies, we conclude that incorporating positive psychology elements in lesson plans allow teachers to promote students' sustainable wellbeing in South Korea.

Introduction

Many South Korean students fail to experience well-being because of the intense pressure to succeed, which leads to the lack of risk-taking or variability in South Korea. About one-third of students in middle and high school of South Korea considered committing suicide. 39.9 percent of the students said that the academic stress caused their contemplation, and 25.5 percent was because of anxiety about the future and future careers (Sorensen 10). Students' academic knowledge is mostly measured by tests in Korea. Although exams are essential to measuring the progress of students and school performance, they are not the whole purpose of schools.

It is a social belief in Korea that if one gets accepted into SKY (equivalent of Ivy League schools in Korea), they will achieve a privileged status in society. Because of this belief, private education systems called *Hagwons* developed, where students attend outside of regular school hours to get extra help. Korea spends about 5 billion dollars on education and many students risk taking a gap year or more to retake the CSAT, which is a standardized test given to students each year to measure their knowledge and determine what college they can get accepted to (Shin 59). As one can see, Korea values education. Since the midst of South Korea's development, Koreans considered education as a gateway for them to escape poverty. Juxtaposed with Confucius beliefs, the idea of education has developed into a concept that is worth competing and fighting for (Sorensen 10). Due to this, South Korea currently is one of the top-performing OECD countries in reading literacy, mathematics, and sciences, and has one of the world's highest-educated labor forces (Shin 59). But as the emphasis on education increases, competition over admission into top colleges is increasing. This has led to the reputation of Korea having the most merciless education systems in the world, spending excessive hours and money on private education.

As a possible approach to mitigate this excessive educational pressure in Korea, Positive Psychology can be implemented in school settings. Positive Psychology is defined as the science of positive subjective experience, the purpose of which is to improve the quality of life and prevent pathologies that arise when life is meaningless (Seligman et al. 159). It mainly focuses on the positive aspects of life, rather than the negative. Positive psychology believes that the emphasis on hope, love, enjoyment, and trust is important since these conditions are often undermined by negative emotions. The purpose of positive psychology is to make people stronger and more productive, and ultimately realize their high potential.

Important Factors of Positive Psychology in Classroom Settings

Sustainable wellbeing, which is the state of high and consistent wellbeing, is the purpose of positive psychology. Well-being is among the many concepts employed regarding the human ability to conduct satisfaction with life, find meaning, and flourish (O'Brien 228). Sustainable wellbeing is achieved when individual wellbeing as well as the wellbeing of other members of society is improved. High levels of well-being allow individuals to flourish in both personal and societal ways. In order to achieve sustainable wellbeing, the five building blocks of wellbeing in

positive psychology, PERMA, can be used (Seligman et al.). 1) Positive emotions: cultivating positive feelings about life which leads to a hopeful outlook on life, which allows one to take more risks and opportunities. 2) Engagement: using mindfulness to develop a full and clear awareness of the present, both physically and mentally. 3) Relationships: creating a good balance in relationships. 4) Meaning: dedicating our time to something greater than ourselves. 5) Accomplishment: having a sense of accomplishment to stay positive and focused. Among these five building blocks of sustainable wellbeing, *engagement, achievement,* and *relationship* are the most significant factors in classroom environments, and these factors can be developed through implementing programs of positive intervention in education.

Engagement

Engagement in terms of positive psychology describes a specific way of being involved with a task. Engagement often means being very focused on that one task (O'Brien 228). It usually occurs when students overcome a new challenge, or when an experience causes positive emotions such as curiosity, joy, and contentment. Experiencing engagement is important for students because, through deep engagement, students are more likely to fully absorb the content and develop the skills that they are trying to gain. This creates a sense of accomplishment, which leads to positive emotions.

By applying PERMA's positive psychology theory of engagement in classroom, teachers will be able to support students to become focused and achieve better learning outcomes. Engagement can be incorporated throughout the classroom in various ways. Teachers can tailor and personalize lessons or activities in order to adapt to each students' strengths and weaknesses. This type of learning is also known as personalized learning. Personalized learning is an effective teaching style that produces great results in student learning and engagement. Personalized learning emphasizes the students' ownership of their learning, while teachers are there to facilitate their learning based on students' interest and need (Grant). Specifically, offering students more chances to make choices, such as topics and assessment types, allows them to apply their strengths and interests to their classwork. This will help students to accurately present their scholastic aptitude and potential compared to those receiving the lectures and assignments without any consideration for individual differences. Moreover, it is important for students to gain access to their own data and progress, especially as a tool for self-reflection. Not only will

this data allow students to figure out their progress and level, but will also help students to know how to improve and what other means they should take to reach their goals. With these two specific steps, personalized learning can drastically improve the generalized and nonexclusive education system of Korea. Korea's rigid system for students to "succeed" uses a single type of learning and assessment. This type of learning is incompatible with the majority of students, yet it is so deeply rooted in the education culture. This eventually leads many students to feel disengaged at school. Personalized learning, by promoting engagement and individual progress, can be an important method for students to stay engaged and foster a growth mindset.

Achievement

Achievement in positive psychology is when students get to see their own progress and development, rather than depending on honorable outcomes. Achievement can be shown in classrooms by celebrating achievements or setting personal goals in order to feel a sense of accomplishment. Achievement is important in a classroom environment because feeling accomplished is an important element for students to develop positive well-being over time. Achievements in education will help students to focus better on their own progress and develop a stronger sense of well-being.

One specific way teachers can foster a sense of achievement in students is through verbal praise. Verbal praise firstly is a simple way that can motivate and celebrate students' accomplishments. Verbal praise becomes more effective when the compliment is specific rather than general. This type of praise allows students to realize what they are doing correctly and increases the likelihood that students will engage in those behaviors in the future. However, there are a few qualifications to give effective verbal praises. Firstly, the praise should not only be about the total product or outcome. While it is good to celebrate the final production of the students' work, it is more important to compliment their progress. Another type of praise known as behavior-specific praise, which focuses on providing specific feedback on student's praisable behavior, should be used to compliment the students' progress (Villeda). Behavior-specific praise acknowledges the students' efforts and achievements through telling them what they did well, as well as telling them what they can improve on. This promotes their will to persist and look for strategies to overcome obstacles in order to reach their final goal. Therefore, students can feel motivated while being less harsh on themselves and overly competitive. This is especially apt for

the competitive and highly pressured education environment in Korea. Because of the universal goal of getting a high score on the CSAT, students are forced to prioritize results over process. No matter how hard a student has worked, or how much he has improved, it is most important for a student to receive a good score on the CSAT. This discourages students from creating a growth mindset. Not only the CSAT, but scores on school tests determine what class students go into, what level of education they receive, and what types of friends they hang out with. It is socially encouraged that a student's score defines who they are and who they will turn out to be. To alleviate this type of stress, it is important to give out progress-based compliments. All students will receive compliments if they receive a high score on a test, but it is also important for their process to get praised as well. This allows students to focus on how they reached the goal, rather than how much of the goal they achieved. What ultimately determines one's well-being in life is not about what test score they received, but how they achieved their score and how they persisted through struggles.

Relationship

Relationship in positive psychology often refers to the good relationships people build with others. Some characteristics in positive relationships can be respect, mutual support, open communication, trust, etc (Heimes 94). Positive relationships can be developed through teachers taking the time to invest in the students, which can include getting to know their interests and needs, providing positive feedback, and helping them reach their potential. Good relationships can also be built through teamwork or active student-to-student interaction because students can practice their communication skills and have the opportunity to explore different viewpoints. Accomplishing good relationships will have an important impact on students' ability to socialize and communicate. Positive psychology approaches encourage stronger relationships to build meaningful connections and improve student wellbeing.

One example of how relationship-based learning can be incorporated into the classroom is through acquiring more opportunities of group discussion. Incorporating methods such as fishbowl debates and one-on-one discussions is important as they allow students to share their ideas and get exposed to many different perspectives. Group discussion not only allows students to gain a wider knowledge, but also allows them to learn how to socialize. Because of the CSAT in Korea, most of the study methods are independent based. However, studying alone often pens

students' thoughts and perspectives as it restrains them from looking at a wider perspective. Independent study also reduces the time of socializing, which is an important aspect of our lives.

Recommendation of Positive Psychology Intervention Methods in Korean Education

Resilience in positive psychology can be defined as the ability to adapt positively despite experiences of adversity or trauma (Alagona 1). The tendency to "bounce back", which means to continue on with our lives despite failure and disappointment, is an important trait to develop. Teaching resilience to students is crucial since it might change the trajectory of the students' lives. Resilience can be built through the three building blocks of sustainable wellbeing: achievement, engagement, and relationships (Seligman et al.). Supportive relationships can enhance a person's resilience because they create love and trust, provide role models, and offer encouragement and reassurance. Engagement in-class activities can help the development of resilience because being involved in an environment where one can constantly learn and be challenged allows students to develop a stronger tendency of resilience as a natural outcome. Achievements can also help students build resilience especially when students accomplish something they thought they were incapable of. Since the characteristic of resilience is an important factor to consider when implementing positive psychology into Korean classroom environments, methods such as group discussions and emphasis on the students' process may be a possible approach.

Group discussions

Group discussion is an important in-class activity that is vital to develop positive relationships and increase engagement. Through group discussions, students are also able to show independence, because they still receive support without being under strict supervision (Flosason et al. 317). When quality group discussions occur, students understand and engage with new ideas and information, which can promote interest and engagement. Through group discussions, students are also developing socially and emotionally by learning different perspectives and ideas of different people by attempting to understand them.

Emphasis on Process

Rather than prioritizing exam scores, it is more important to focus on the process of acquiring the knowledge. Test scores and grades may not accurately reflect a learner's success or failure. This can lead to a student's misunderstanding of their potential. However, the process-oriented approach to teaching and learning falls in line with the classroom instructional goals such as growth mindset and mastery. The emphasis on the process can be implemented in many ways when designing lesson plans. For example, a teacher can constantly give feedback to students on their progress which will allow them to improve and grow. Students' sense of achievement can be enhanced through the emphasis on progress because they can see constant growth, which creates a bigger and better sense of accomplishment when they see their final result.

Research Hypothesis

These points lead to my primary question: How can teachers integrate positive psychology into their lesson plans to let Korean students experience sustainable wellbeing? To approach this question, I thought of two hypotheses. The first hypothesis is utilizing group discussions in daily lessons in order to allow students to input their thoughts, and potentially experience failure by being challenged by others' thoughts. My second hypothesis is the stronger emphasis on process. Stronger emphasis on process provides room for improvement. This can be seen through providing various styles of assessments, assignments, and active feedback. Through these processes, students will be able to develop resilience which is the main factor to gain sustainable-well being. In order to test out the hypothesis, I have come up with the following study plan.

Study Design Methods

For this study, the participants will be students in grades 10, 11, and 12 who are attending South Korean academic schools. The research's focus is on South Korean education and how positive psychology can be integrated into the existing classroom environment in South Korea. Therefore, the students must be someone who experienced Korean education for at least their secondary years. The students should also be in Grade 10, 11, or 12 since the secondary school course in South Korea consists of three years, which is equivalent to Grade 10, 11, and 12 in Western educational system. However, I will be excluding international schools in Korea that

teach an international or western curriculum, because a different curriculum may interfere with generalizing the classroom environments.

Ethical Considerations

Ethical approval will be obtained from the students and guardians of the students. All guardians and students will be asked to write a written consent form in order to participate in the experience, and they will all have the right to withdraw from the study at any time.

Educational Interventions

Critically, the process of simply putting students in groups does not guarantee rich collaboration. In fact, unstructured groups can have negative effects, including decreased motivation, and negative pressures of participating and dealing with conflict between students. Therefore, creating an inclusive environment and set of norms for the class to follow during discussions can be a possible procedure to create high-quality discussions.

To reduce such possibilities of negative outcomes, purposely structuring elements of student interaction is important. This includes enforcing individual accountability within the group, encouraging promotive interaction among members, and framing tasks in such a way that supports positive interdependence among group members. It is also important to collectively establish behavioral expectations for the discussions through a set of class norms and hold students accountable to these norms. Interacting with peers according to a set of norms can increase effectiveness because it allows students to match a certain expectation (Flosason et al. 317). Individual accountability can be held through setting norms and standards. For example, before having a discussion, setting plans of where the discussion should lead to by creating questions beforehand, or even choosing the minimum amount a person can speak can lead to a better discussion. Creating an inclusive classroom environment is also crucial because it encourages promotive and active interaction amongst members. Creating an inclusive environment ultimately promotes all students to participate. While it is the goal for all students to share their opinions, it is also important to not let certain students dominate the discussion. These discussions can occur in every class, where students share what they learned and gather different opinions from other students .

Emphasizing progress can look very different for each lesson or subject. However, a general idea of implementing various forms of formative assessments can be effective. Formative assessment means by which students receive input and guiding feedback on their relative performance to help them improve (Hattie and Timperley 81). It can be provided face to face during office hours, written comments on assignments, rubrics, or digital communications (Shute 153). Formative assessments can be used to measure student learning on a daily basis. These assessments reveal how and what students are learning during the course and often inform the next steps in teaching and learning. Assessments can be seen in various forms. For example, a discussion post on the topics learned, small quiz, worksheet/journals, or homework assignments.

Measures

The Connor-Davidson Resilience Scale (CD-RISC) comprises 25 items, each rated on a 5-point scale (0-4), with higher scores reflecting greater resilience (Meadows et al. 9). CD-RISC is a scale that assesses resilience, originally created to measure how the treatment studies of PTSD not only reduce symptoms of the disorder but how the subjects are able to handle stress and become more resilient. The measure showed satisfactory reliability, positive associations with emotional, psychological, and social wellbeing, and negative links with negative emotional states. The CD-RISC is verified, as the scale has now been translated into many different languages and studied in a variety of populations, including large community samples, survivors of various traumas, a selected professional or athletic groups (e.g. university students, nurses, physicians, social workers, etc.) (Min et al. 231)

Expected Results

The effectiveness of positive psychology in lesson plans can be assessed by giving a self-report questionnaire to two groups of students, where one group experienced a year of learning that included aspects of positive psychology, whereas the other group experienced a year of learning with the original/traditional Korean lesson style. Participants in both groups will be asked to answer the CD-RISC after the course has finished. The results from the scale will be used to test the correlation of the effectiveness of implementing positive psychology into lesson plans. According to the hypothesis, students who use positive psychology will give higher scores than those who do not.

Conclusion

The study hopes to establish a new standard of education in Korea, where the power of efforts and growth are more valued than the mere results. School is not a place where students only learn how to memorize information in order to pass exams, but where students are prepared to face the unfamiliar challenges that life will throw at them. This can be achieved through building and developing resilience, which is one of the main goals of Positive Psychology. By suggesting potential Positive Psychology intervention methods that are specifically designed for the Korean educational environment, the study hopes to foster a healthier educational system in which students will be better guided to achieve their full potential.

Works Cited

Alagona, P. S. "Resilience." Resilience: A Journal of the Environmental Humanities, vol. 1, no. 1, 2014, pp. 1-15. DOI: 10.5250/resilience.1.1.01.

Cheng, Y. C. "Classroom Environment and Student Affective Performance: An Effective Profile." The Journal of Experimental Education, vol. 62, no. 3, 1994, pp. 221-239. JSTOR, www.jstor.org/stable/20152415.

Delialioğlu, O. "Student Engagement in Blended Learning Environments with Lecture-Based and Problem-Based Instructional Approaches." Journal of Educational Technology & Society, vol. 15, no. 3, 2012, pp. 310-322. JSTOR, www.jstor.org/stable/jeductechsoci.15.3.310.

Flosason, T. O., et al. "Evaluating Impact of Small-Group Discussion on Learning Utilizing a Classroom Response System." Journal of Behavioral Education, vol. 24, no. 3, 2015, pp. 317-337. JSTOR, www.jstor.org/stable/43551326.

Grant, Patrick. Personalized Learning: A Guide for Engaging Students with Technology. International Society for Technology in Education, 2014.

Hattie, J., and H. Timperley. "The Power of Feedback." Review of Educational Research, vol. 77, no. 1, 2007, pp. 81-112. JSTOR, www.jstor.org/stable/4624888.

Heimes, M. "Building Positive Relationships." YC Young Children, vol. 64, no. 1, 2009, pp. 94-95. JSTOR, www.jstor.org/stable/42731038.

Martin E. P. Seligman, and Pawelski, J. O. "Positive Psychology: FAQs." Psychological Inquiry, vol. 14, no. 2, 2003, pp. 159-163. JSTOR, www.jstor.org/stable/1449825.

Meadows, S. O., et al. "Understanding Resilience." Airman and Family Resilience: Lessons from the Scientific Literature, RAND Corporation, 2015, pp. 9-22. JSTOR, www.jstor.org/stable/10.7249/j.ctt19rmdbt.10.

Min, J.-A., et al. "Characteristics Associated with Low Resilience in Patients with Depression and/or Anxiety Disorders." Quality of Life Research, vol. 22, no. 2, 2013, pp. 231-241. JSTOR, www.jstor.org/stable/24722697.

O'Brien, C. "Happiness and Sustainability Together at Last! Sustainable Happiness." Canadian Journal of Education / Revue Canadienne de l'éducation, vol. 36, no. 4, 2013, pp. 228-256. JSTOR, www.jstor.org/stable/canajeducrevucan.36.4.228.

Pajares, F. "Toward a Positive Psychology of Academic Motivation." The Journal of Educational
Research, vol. 95, no. 1, 2001, pp. 27-35. JSTOR, www.jstor.org/stable/27542354.

Seligman, M. E. P., et al. "Positive Education: Positive Psychology and Classroom
Interventions." Oxford Review of Education, vol.

Shin, Jung Cheol. "Higher Education Development in Korea: Western University Ideas,
Confucian Tradition, and Economic Development." Higher Education, vol. 64, no. 1,
2012, pp. 59-72. JSTOR, www.jstor.org/stable/41477919.

Shute, Valerie J. "Focus on Formative Feedback." Review of Educational Research, vol. 78, no.
1, 2008, pp. 153-189. JSTOR, www.jstor.org/stable/40071124.

Sorensen, Clark W. "Success and Education in South Korea." Comparative Education Review,
vol. 38, no. 1, 1994, pp. 10-35. JSTOR, www.jstor.org/stable/1189287.

The Impacts of the Avant-Garde Movement Throughout Art History By Minju Kang and Francesco Cassini

The etymology of the word "Avant-garde" traces back to its original French term, which was used to refer to the vanguard of an army. Although the term's original usage was not intended for the arts, it rose in the art world during the 19th century, when cultural changes such as industrialism, urbanisation, and modernism occurred. Artists found themselves in a volatile world, and aesthetics followed that path of evolution. Becoming the vanguards of the art sphere, these artists challenged the conventions of previous art movements and sought new definitions of art (Kleiner 389).

Consequently, Avant-garde art became a much larger movement that strives to rethink the nature of art and its relationship to the individual and civilization. This essay will explore how the Avant-garde movement revolutionised art history, creating a ripple effect that holds influence over art movements from modern to contemporary art, ultimately impacting how we view art today and the limits of its growth.

Background

Ever since the Avant-garde transpired with the Impressionist movement, it has made a ripple effect of influence across many movements that came afterwards and even continue today in contemporary art. Consequently, the influence of today's contemporary art can be traced back to the advent of modern art back in the 1800s. It is widely believed that the Impressionist movement paved the way for the beginning of the radical Avant-garde when artists rejected realism, which was the norm, and opened their compositions to capture the transient presence of light and movement. Artists including Claude Monet, Pierre-Auguste Renoir, and Edgar Degas defined this style with visible brush strokes, little blending, and vivid colours. However, the advent of the movement did not receive a warm welcome, as public reception was negative and critical. The new modernist art challenged the long, established artistic conventions, thus, was rejected and censored by government-funded Salons. Eventually, the

2

artists resorted to independent exhibitions where they could showcase their experimental works to the public (Kleiner 369).

The Impressionist movement would begin a chain of movements where one movement influences the next. Over time, the Impressionist movement gained popularity and became so well-received that a new movement was formed to break the conventions of its predecessor. Post-Impressionism was introduced to reject the limitations of Impressionism and represent their interpretations of their perception of the world using bold colours and expressive and symbolic imagery. Just like its preceding movement, the Post-Impressionism front gained momentum from artists who sought to innovate and experiment and eventually became the defining art style of its period (Museum of Modern Art).

Avant-Garde in Action

What was once Avant-garde and radical eventually rose in popularity and became the norm and tradition that inspired the next progressive movement. After the Post-impression, Expressionism followed, which rejected bourgeois values and focused on personal expressions regarding modernity using distortions and lurid colours (Museum of Modern Art). Cubism also succeeded Expressionism, which deconstructed the norms of the previous movements by challenging the rules of perspectives. They incorporated different perspectives of the same subject into the same painting, which re-invented form and space.

The next movement was Futurism, which captured the power of machines and the vigour of modernity, welcomed the rise of new technology and modernization, and denounced the oppressive culture of the past (Altshuler 78). This movement further inspired significant art movements such as Dada, the satirical anti-war movement that rejected all logic, reason, and order of western civilization that led to World War I and favoured chance, spontaneity, and irreverence (Altshuler 98).

Following Dada emerged Surrealism, which explored the intricate tapestry of the mind by drawing inspiration from the subconscious to rethink the human experience. After Dada came Abstract Expressionism, which committed to abstract art that powerfully expressed individualism, manifesting itself in bold forms of lively gestural paintings or meditative

colour field painting, marking the beginning of the postmodern body of art history. The evolution of the Avant-garde proves that art movements are always an ever-changing variant. However, the pursuit of the radical remains the constant that has driven artists throughout the evolution of modern art.

Avant-gardes remained a major driving force that shaped the evolution of art throughout the postmodern movement and even in contemporary art today through both direct and indirect influence. For example, influential Dada artist Marcel Duchamp, known for his use of readymade works such as Fountain (1917) and Bicycle Wheel (1913), serves as a direct inspiration to postmodern and contemporary artists (Kleiner 400). His philosophy argues that ordinary mass-produced objects are independent of the standards of "good or bad taste" determined by society, thus, can be promoted as high-status art. This philosophy has inspired several prominent artists from both postmodern and contemporary eras, such as Andy Warhol, Damian Hirst, and Jeff Koons.

Andy Warhol, one of the most iconic pop art figures, championed Duchamp's pursuit of the
mundane mass-produced product. Warhol continues Duchamp's argument that everyday objects can become elevated as art pieces and challenges viewers to rethink the question: what makes art, art? His fascination with the everyday object can be seen in his notable works such as Green Coca-Cola Bettes (1962) and Campbell's Soup Cans (1962) (Kleiner 435; Museum of Modern Art). Contemporary artists such as Damien Hirst and Jeff Koons carry on Duchamp's legacy.

Damien Hirst presented his take on the readymade form by suspending animal carcasses in formaldehyde solution, demonstrated in his most notable works such as The Physical Impossibility of Death in the Mind of Someone Living (1991) and Mother and Child (Divided) (1993) (Manchester). Jeff Koons, known for his stainless steel sculptures of balloon animals, including Rabbit (1986) and Balloon Dog (1994), also champions Duchamp's vision of glorifying everyday objects by transforming them into enlarged and lustrous structures (Museo Jumex).

Even today, artists open themselves to new ways of innovation and continuing the spirit of Avant-garde. As they challenge the status quo, the public is exposed to works that spark controversy and debate, pushing the boundaries of what is acceptable in art and forcing culture to progress into its next stage. Ever since the appearance of the Avant-garde, searching for the next revolutionary idea became the goal for many artists throughout modern art history, bolstering the prosperity of the movement; however, the pursuit of the radical also has its limits.

According to Avant-Garde and Kitsch, an essay written by Clement Greensburg, the Avant-garde evolves because of its "ever-changing" nature; however, its continued existence relies on a delicate balance between its rebellious nature and financial investment. In order to manifest revolutionary ideas, artists must reject widely accepted conventions, which inevitably leads to these artists rejecting the values shaped by the bourgeoisie. However, Greenburg points out that Avant-garde art requires social and financial support, and many artists turn to the wealthy to fund the arts. Therefore, to spread radical ideas to the masses, the Avant-garde must maintain its "umbilical cord of gold" to the wealthy, paradoxically becoming dependent on the ruling class (Greenburg 38), in order to revolutionise culture and secure funding at the same time.

Greenburg stresses that the Avant-garde is only possible under a democratic socialist society where the quality of the arts, freedom of expression, and social critique can flourish (Greenburg 49). Although the Avant-garde stays strong and prosperous today, its ability to stay true to its rebellious nature and remain accessible to its audience is limited.

Conclusion

Since the beginning of modern art, Avant-garde art has evolved into a timeless force of nature that drives generations of artists to chase the next revolutionary idea. Although its survival relies on a fragile equilibrium between radical pursuits and financial security, it continues to prosper within contemporary art, shaping how we view art today. As the movement forces the public to question previous beliefs, it progresses the art world and advances our ideas and culture to the next level.

Works Cited

Altshuler, Bruce. The Avant-Garde in Exhibition New Art in the 20th Century. University of California Press, 1998. Greenberg, Clement. "Avant-Garde and Kitsch." Art and Culture: Critical Essays, Beacon

Press, Boston, MA, 1989, pp. 3-33. Kleiner, Fred S. Gardner's Art through the Ages: A Concise Global History, Third Edition. Edited by Sharon Adams Poore, Cengage Learning, 2017.

Manchester, Elizabeth. "Mother and Child (Divided)', Damien Hirst, Exhibition Copy 2007 (Original 1993)." Tate, 2009 https://www.tate.org.uk/art/artworks/hirst-mother-and-child- divided-t12751.

Museo Jumex, "Apariencia Respuda El Desco y El Obiete En La Obra De Marcel Duchampy Jeff Koons Aun." Museo Jumex, 2019, https://www.fundacionjumex.org/en/exposiciones/181-apariencia-desnuda-el-deseo-y-El-objeto-en-la-obra-de-marcel-duchamp-y-ieff-koons-aun

Museum of Modern Art. "Expressionism." The Museum of Modern Art, 2022, https://www.moma.org/collection/terms/expressionism. Museum of Modern Art. "Post-Impressionism." The Museum of Modern Art, 2022, https://www.moma.org/collection/terms/post-impressionism.

Rosenthal, Nan. "Marcel Duchamp (1887-1968)." The Met, The Metropolitan Museum of Art, Oct. 2004, https://www.metmuseum.org/toah/hd/duch/hd_duch.htm.

A Report of an Investigation on the Applicability of the Ideal Gas Law to Real Gases by Simulating the Behavior of Argon through Molecular Dynamics Modelling

By Liling Mei

Abstract

The ideal gas law $PV = nRT$ is used in the demonstration of the gases with the ideal gas property, which has the limitation of using it in the real gases. In contrast, the full expression of the ideal gas law proposed by van der Waals, which is also called the van der Waals equation is more applicable to real gases. This report investigates the applicability of the ideal gas law to real gases by using argon gas as an example. The investigation is mainly done through the simulation of the behavior of the argon gas, Molecular Dynamics modelling is used in the simulation, and the Gnuplot and Genetic Analysis are mainly used in the data analysis. The experimental data in this report resulted from the MD calculation shown on the Gnuplot demonstrates that the ideal gas law is more applicable in real gases with low density and high temperature.

Introduction

The ideal gas equation demonstrates the relation between the pressure, temperature, and volume of ideal gases, which is $PV = nRT$, where P stands for the pressure of the ideal gas, V stands for the volume of the ideal gas, n stands for the number of moles of the ideal gas, R is the universal gas constant, and T stands for the temperature of the ideal gas in Kelvin. The ideal gas is the perfect gas that is assumed to have the following properties, including the negligible volume of gas molecules compared to the volume of the container, the gas molecules having the same size and negligible intermolecular force between gas molecules, the gas molecules moving randomly, and the gas molecules having perfect elastic collisions, which implies the conservation of both momentum and energy [1]. However, because real gases do not obey the assumptions of the ideal gas, the result of the calculation of the pressure, temperature, and volume of real gases through the ideal gas equation will be inaccurate compared to the actual values. This report will show the relation between the pressure and temperature as well as the pressure and temperature obtained through simulation of argon, a real gas, using Molecular Dynamics (MD).

Molecular dynamics (MD) is a method that follows the evolution of a system of interacting particles by integrating the equations of motion $F = ma$, where F is the force exerted on each particle which depends on all other particles, m is the mass of each particle, and a is the acceleration of the particle [2]. The integration of the equation of motion of each particle refers to increasing the time in small steps and determining the positions of all particles at these discrete times, and this implies the iteration of calculating all forces of particles by using the positions at the current time, getting the acceleration of each particle, computing the positions of particles at the new time from the current positions and the current velocities, and computing the velocity at the new time from the current velocities and accelerations (or, equivalently, from the old and new positions). The scheme used to compute the new positions and velocities from those at an earlier time is the Verlet algorithm, which follows the simple form of Taylor expansion of the positions $x(t)$ as the function of time. The $x(t)$ will be written as

$$x(t + \Delta t) = x(t) + \frac{dx(t)}{dt} \Delta t + \frac{1}{2} \frac{d^2 x(t)}{dt^2} (\Delta t)^2 + \frac{1}{6} \frac{d^3 x(t)}{dt^3} (\Delta t)^3 + \cdots,$$

and the velocities will be obtained via

$$v(t) = \frac{x(t+\Delta t) - x(t-\Delta t)}{2\Delta t}.$$

Hypothesis

The higher the temperature and the lower the density, the more applicable the ideal gas equation is to the real gas.

Methodology

1. Collecting data of pressure at different temperatures and densities from argon simulation

   i. Set the information of the "argon" simulation in the "control.argon" file as Figure 3.1 shows below. Input the density of argon as 0.05 gcm^{-3} and the temperature of argon as 300K.

Figure 3.1. Input information in the "control.argon" file

ii. Set the new file "ctn", which stands for the nth temperature setting control file, with the same density of 0.05 gcm^{-3} and 10 different temperatures of argon by changing the temperature in the "control.argon" file from 50K to 600K with a temperature change interval of 50K.

iii. Create a file "job" including the commands of running the simulation with different "ctn" control files with various temperatures and store each result into the "otn" file, which stands for the nth temperature setting outcome and also the commands for extracting the pressure by using "moldyext" to extract the values of stress which corresponding to the column 11, 19, 26 in the "otn" outcome files and store each result into the "ptn" file, which stands for the nth temperature setting pressure.

iv. Run the "job" file to automatically simulate the argon at different temperatures and obtain all the outcomes "ptn" files.

v. Create a file "calculation" including the commands of using the "genetic analyzer" ("ga") to calculate the average of each column of stress in the "ptn" files and get the data of the pressure of argon at different temperatures.

vi. Repeat steps i. to v. above at a constant temperature of 600K and only replace the change in temperature with the change in the density of the argon from 0.05 gcm^{-3} to 0.50 gcm^{-3} with a density change interval of 0.05 gcm^{-3} and get the data of the pressure of argon with different densities.

2. Plot the graph of pressure and temperature as well as the pressure and density

    i.   Use "gnuplot" to plot the graph that shows the relationship between pressure and temperature with error bars by using the data in the "ana.dat" file created from "ga".

   ii.   Repeat the step above and plot the graph that shows the relationship between pressure and density with error bars.

  iii.   Plot the graph of the theoretical pressure calculated from the ideal gas equation.

  iv.   Compare the experimental data points with the theoretical line to deduce the applicability of the ideal gas equation to the real gas.

Data

1. Data collection

The pressure data at different temperatures and densities are shown below, calculated by the "ga".

Figure 4.1 is the data of pressure at different temperatures. The first column is the temperature of the argon in Kelvin, the fourth column is the pressure of argon in the x direction in Mega Pascal, and the fifth column is the uncertainty of the pressure in the x direction.

Figure 4.1. Data of pressure with different temperatures in the "ana.dat" file

Figure 4.2 is the data of pressure at different densities. The first column is the density of the argon in gcm^{-3}, the fourth column is the pressure of argon in the x direction in Mega Pascal, and the fifth column is the uncertainty of the pressure in the x direction


Figure 4.2. Data of pressure with different densities in the "ana.dat" file

2. Data processing

The graph shows the temperature and pressure relation by using gnuplot. Plot the graph with x-axis temperature and y-axis pressure as well as the error bars for the pressures by using the corresponding column of data in the "data.ana" file, which refers to the first column for temperature and the fourth column for the corresponding pressure as well as the fifth column for the error bars.

2.1. Temperature and pressure relation

Using the command "plot "ana.dat" u 1:4 w lp, "ana.dat" u 1:4:5 w yerr" (without the quotation marks) in the gnuplot to plot the graph that shows the temperature and pressure relation below in Graph 4.3, where "1:4:5 w yerr" stands for the x-axis temperature and the y-axis pressure with y-direction error bars in the corresponding first, fourth, and fifth columns of data in the "ana.dat" file.

224
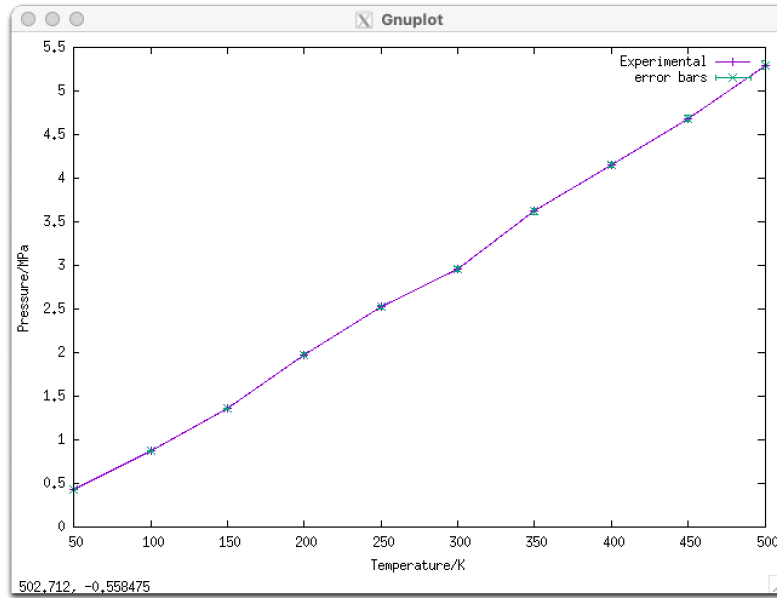
Graph 4.3. Graph of pressure with varying temperatures by Gnuplot

2.2.Density and pressure relation

Use the same command as above with the density "ana.dat" file in gnuplot to plot the graph that shows the density and pressure relation below in Graph 4.4, where the "1:4:5 w yerr" stands for the x-axis density and the y-axis pressure with y-direction error bars in the corresponding first, fourth, and fifth columns of data in the density "ana.dat" file.
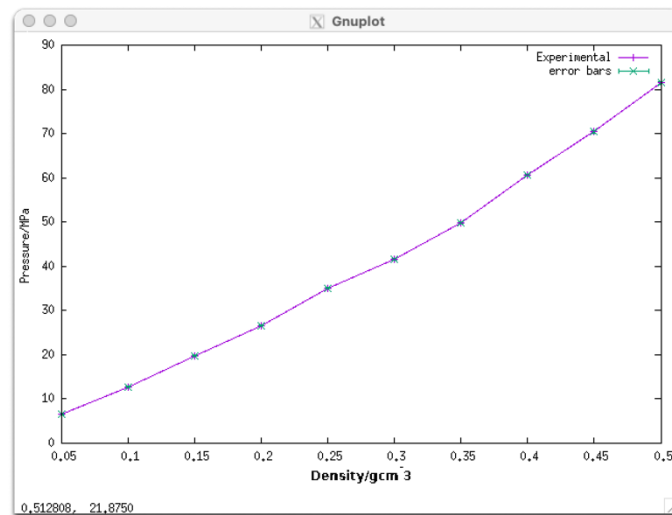
Graph 4.4. Graph of pressure with varying densities by Gnuplot

3. Data analysis

The ideal gas equation is $PV = nRT$, and it can also be written as $P = \frac{nRT}{V} = \rho RT$,

where ρ is the density of gas in $mol\ m^{-3}$, R is the ideal gas constant 8.314 $Pa\ m^3 mol^{-1}K^{-1}$, and T is the temperature of the gas in K.

3.1. Temperature and pressure relation

When investigating the relationship between pressure and temperature by changing the temperature of argon, the other conditions including density are all constant. As a result, the relation between temperature and pressure based on the ideal gas equation will become

$P = \rho RT = T \times c$, where $c = \rho R$ which is a constant in $Pa\ K^{-1}$. According to the equation $P = T \times c$, the theoretical pressure and temperature relation from the ideal gas equation should be linear with the gradient of $c = \rho R = 0.05 \times \frac{1}{39.948} \times 8.314 \times 10^6 = 0.0104\ MPa\ K^{-1}$.

Then, the relation between pressure and temperature will be written as $P = T \times c = 0.0104 \cdot T$.

Plot the graph of $P = 0.0104 \cdot T$, which is the theoretical relation between pressure and temperature to compare with the graph of data from the simulation result.
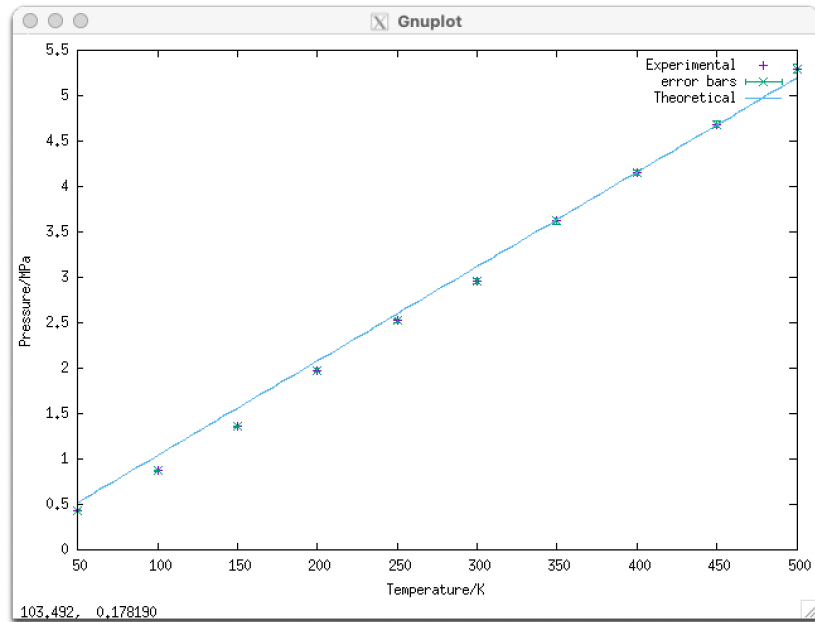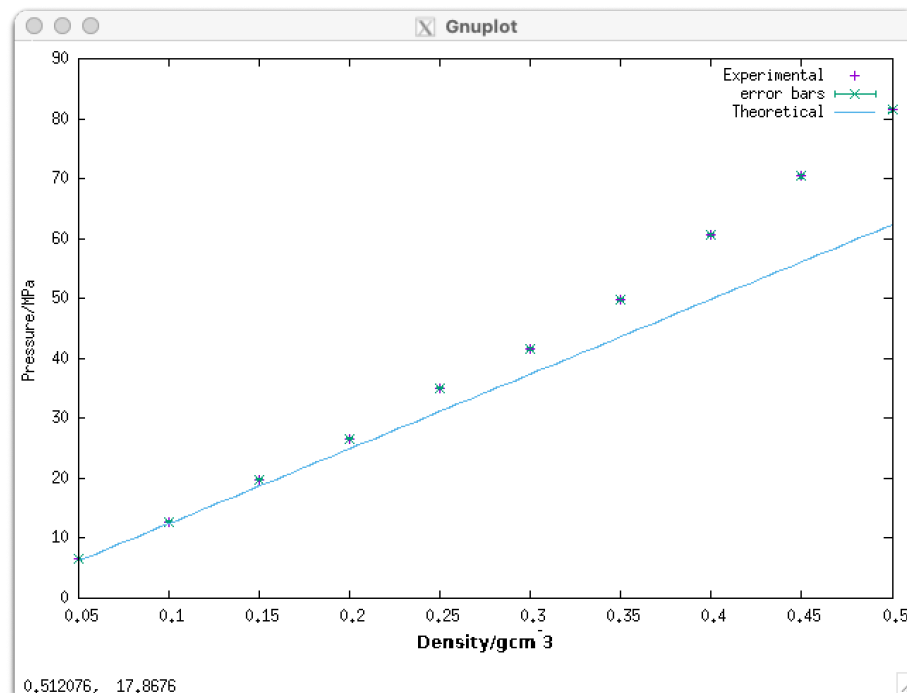

Graph 4.5. Graph of experimental data points and a theoretical line for the pressure as a function of temperature.

In Graph 4.5, the accuracy of the experimental points to the theoretical line is higher when the temperature gets higher since the data points with temperature higher than 350K are fit for the theoretical line compare to the data points lower than 300K. This shows that the pressure of argon will be more similar to the pressure calculated from the ideal gas equation when the temperature is higher, since the higher the temperature of argon, the higher the kinetic energy and the less potential energy that each argon atom will have, which gives a smaller intermolecular force between argon atoms. As a result, when the temperature is higher, argon will be closer to the ideal condition as it gets closer to the ideal gas assumption of negligible intermolecular force between gas molecules. This means the ideal gas equation is more applicable in the higher-temperature real gas compared to the lower-temperature real gas.

3.2.Density and pressure relation

Follow the same logic of the relation between pressure and temperature to compare the experimental data and theoretical calculation from the ideal gas equation with varying densities. The theoretical equation of the pressure and density relation will be written as $P = \rho RT = \rho \times d$, where d is a constant which is in $Pa\,m^3 mol^{-1}$ and

$d = TR = 8.314 \times \frac{600}{39.948} \times 10^6 = 124.87\,MPa\,m^3 mol^{-1}$, which is a constant, and c is also the gradient of the linear relation between pressure and density. Then, the relation between pressure and density will be written as $P = \rho \times c = 124.87 \cdot \rho$.

Plot the graph of $P = 124.87 \cdot \rho$, which is the theoretical relation between pressure and density to compare with the graph of data from the simulation result.

Graph 4.6. The comparison between experimental and theoretical graphs of pressure with varying densities from Gnuplot

In Graph 4.6, the experimental data points are much further to the theoretical line when the density is higher. Because the ideal gas equation is $P = \frac{nRT}{V}$, and the V is the volume of the container which does not consist of the volume of the gas molecules, and the increase in densities will increase the volume of the gas molecules in the container. Therefore, the volume used in the ideal gas equation calculation is higher than the actual condition, so the theoretical pressure calculated will be lower.

This shows that the pressure of argon will be closer to the pressure calculated from the ideal gas equation when the density is lower. The lower the density of argon, the fewer argon molecules will exist in a given volume.

Conclusion

Based on the calculated result of pressure with different temperatures and densities of argon by the MD refer to Figure 4.1 and Figure 4.2 and the corresponding plotting done by Gnuplot refer to Graph 4.3 and Graph 4.4, the comparison between the experimental result from

the MD and the theoretical calculation from the ideal gas equation is carried out to investigate the appliable of the ideal gas equation on the real gas condition.

When the argon has the constant density of $0.05\ gcm^{-3}$ and varying temperatures from 50K to 600K, the data points with the temperature higher than 350K is much fit to the theoretical line, and the accuracy of the pressure calculated from the MD is increasing as the increase in temperature. Also, because the increase in temperature will lead to a decrease in intermolecular force between atoms, argon will be closer to the ideal gas condition with negligible intermolecular force, making the ideal gas equation more applicable in higher-temperature real gases.

When the argon has the constant temperature 600K and varying densities from 0.05 gcm^{-3} to $0.50\ gcm^{-3}$, the deviation of the pressure calculated from the MD is decreasing as the increase in densities. In addition, because the volume of gas molecules will take a smaller proportion in the whole volume of gas in the lower density of the gas, argon will be closer to the ideal gas condition which has a negligible volume of gas molecules, which will make the ideal gas equation more applicable in lower-density real gases.

Works Cited

Kevin M., Tenny, and Jeffrey S. Cooper. "Ideal Gas Behavior." Europe PMC, Europe PMC, July

20, 2017, https://europepmc.org/ article/nbk/nbk441936.

Nature News, Nature Publishing Group, https://www.nature.com/ subjects/molecular-dynamics.

Analyzing the Decoupling Relationship Between Marine Pollution and Marine Economic Growth in the Shenzhen City During the Period of Rapid Urbanization From a Historical Perspective By By Longhao (Stephen) Xu

1.Abstract

Shenzhen, formerly a fishing village, has been designated as the country's special economic zone ever since China began to open and implement economic reform in 1978. Shenzhen's advantageous geographic location near the water and the new policy enabled Shenzhen to achieve rapid urbanization. As a result, this had a substantial impact on the region's water quality and marine ecosystem degradation. Though the investigation of multiple related studies, the research paper seeks to discover and examines the relationship between the expansion of the marine economy and marine pollution in Shenzhen Bay. In this paper, the impacts of urbanization to marine pollution will be analyzed through different lenses: Human capital, financial development, and technical innovation. The study found that urbanization causes more harm to the marine environment than does marine economic expansion in terms of marine pollution.

The keywords: Marine ecosystem, Marine economy, Human capital, Financial development, Technical innovation

2.Introduction

A coastal zone is conducive to lessening the paradox between land shortage and urban population growth expansion needs (Crawford, 2007). Many countries, Italy, Singapore, Japan, Netherlands, India, and China, have addressed their land deficit issues through sea reclamation (Cai et al., 2017). More often, coastal areas are urbanized with a better-developed economy and denser population (Mori & Takemi, 2016) than inland areas. Hence, marine and terrestrial ecosystems are impacted by human activities and are more vulnerable than other areas due to their ecological environment being exposed to degeneration (Deng et al., 2015). Rapid socioeconomic development and population growth gradually amplify the possible ecological issues of the coastal ecosystem due to intensified social and economic activities. These environmental issues comprise wetland loss, coastal erosion, and water quality deterioration

(Chen et al., 2007) which have aroused global concern.

In China, since the 'One Belt, One Road initiative (Pavlicevic, 2015), several new advancements and trade initiatives have been introduced to promote China's coastal development. For instance, Shenzhen was the first special economic zone created after China's program of economic reforms that started in 1978. The small township rapidly developed into a modern residential, commercial, and urban industrial city (SKLAIR, 1991). While the coastal city coastal zone has undergone rapid urbanization, its growth and advancement are starting to stabilize (Guo et al., 2011). However, some of the issues experienced during rapid urbanization include ecological problems, such as wetlands reduction and heavy metal pollution (Deng et al., 2015). These problems were caused by disorderly developmental activities and over-exploitation of the coastal city ecosystem resources. Consequently, water quality deterioration continues to be a severe issue in the coastal city. For around three decades now, surface water decline has corresponded with rapid economic growth in many cities in China despite adopting current water management guidelines (Qin et al., 2014). Many studies have demonstrated that such decline is attributed to the complex interplay between engineered infrastructures and legal, political, economic, and social issues during rapid urbanization (Qin et al., 2014). Although most of these studies address water pollution in urbanized places rather than catchment areas or water bodies in rapid urbanization. Additionally, fewer researchers have explored the integrated effect of infrastructure development and socioeconomic factors on water pollution. The current understandings of the effect of urbanization on water pollution are mainly unreliable. Hence, there is a need for further research to produce a more conclusive understanding of water pollution and quality alterations in the context of socioeconomic advancements.

Based on the Shenzhen Bay coastal waters in China as the case study, this paper will analyze the decoupling relationship between marine pollution and marine economic growth in Shenzhen city during the period of rapid urbanization from a historical perspective. The objectives of this study are: (1) to characterize the Shenzhen Bay water quality changes and better understand the factors that contribute to its marine water pollution; and (2) to assess the impact of marine infrastructure development on the marine ecosystem.

3.Literature review

Oceans comprise around 70% of the earth's surface area and harbor numerous natural treasures. Land resources are becoming scarce. Hence, oceans are increasingly proving to be a

valuable treasure. For instance, China has the world's fourth-longest coastline, so the marine economy has significantly contributed to its overall economic growth. For over three decades, China's gross ocean product (GOP) has predominantly shown a two-digit growth rate yearly, with the total GOP significantly increasing (Chen et al., 2017). According to the State Oceanic Administration of China, it is predicted that by 2030, the GOP in China will surpass CNH 20 trillion under normal conditions. Hence, as a medium for economic growth, the marine economy has proved to be of great value to China.

However, the increased overexploitation of the marine economy does not meet the requirements of sustainable development. The marine ecosystem is adversely impacted by unsustainable human activities such as overfishing, coastal ecosystem damage, overflow due to gas and oil exploitation, ocean climate change, and land-based sources of pollution (Halpern et al., 2008). Specifically, recent technological advancement has significantly accelerated the exploitation of ocean resources and harmed the marine environment. Thus, modifying the marine ecosystem through pollution, invasion of exotic species, and destruction of habitats. The 'Agenda21' publication in 1993 by the United Nations declared that oceans are a critical fraction of the global life-support system and a treasured sustainable development asset (Shao, 2020). However, over half of the globe's offshore eco-environment systems are contaminated by urban development-linked activities. In most developing nations, approximately 90% of sewage waters are discharged into coastal and river catchment areas without treatment (Xu & Zhang, 2022).

Besides, the worldwide economic losses from marine destruction amount to USD 13 billion yearly (Xu & Zhang, 2022). Particularly in China's coastal cities, since the reform and opening up, the economic aggregate of its coastal cities has significantly grown with urbanization. These coastal cities' rapid urbanization and economic growth are attained at the environmental expense. Not only does it damage the cities' ecosystems, but it also pollutes the coastal waters beyond their self-purification capacity around the cities. According to preliminary official statistics of China, roughly 80% of all pollutants entering the coastal waters stem from land-based sources (Xu & Zhang, 2022). China Marine Ecological Environment Status Bulletin in 2019 reveals that generally, the average water quality levels in China's coastal sea zones in 2019 was around 46.6%, with class I water quality deteriorating by 7.5% annually (Xu & Zhang, 2022). Additionally, the total amount of pollutants released from rivers into coastal waters is

significantly high, most of the marine ecosystem is unhealthy, and the region of green tide disasters is growing.

Many coastal zones in developing nations are increasingly undergoing rapid urbanization. These areas are experiencing the challenge of preserving water quality while enabling population expansion and economic growth. Comprehending the mechanisms and characteristics of water quality alterations in these areas can aid policymakers in assessing the effectiveness of water management measures, preventing the recurrence of previous faults, and promoting sustainable environmental development. Hence, numerous studies have examined the characteristics of the modifications in water quality during urbanization. Ren et al. (2003) demonstrated that urbanization from 1947 to 1996 in Shanghai coincided with a fast decline in water quality in the Huangpu River. Consequently, Chang (2005) found that with rapid economic growth and urbanization, the Han River water quality in Korea significantly deteriorated during the period between the 1960s and 1970s, but after the implementation of control measures in the 1980s, it improved. Furthermore, Kannel et al. (2007) spotted swelling phosphorus traces in Nepal's urban region of the Bagmati River catchment from 1999 to 2003. Hence, it is widely acknowledged that industrial activities and population growth are drivers of pollution and water quality changes. Groppo et al. (2008) found that increased untreated sewage and population increases were the primary causes of the diminishing water quality in rivers in the State of Sao Paulo, Brazil. On the other hand, Ma et al. (2009) discovered gradual increases in domestic discharge and industrial pollution were the leading causes of the decline in the water quality in the Shiyang River, Northwest China. Appropriate water management measures can be incorporated into the urbanization process to moderate water quality decline, such as wastewater infrastructure installment to facilitate wastewater treatment capacity (Qin et al., 2014). Consequently, socio-economic policies, including fiscal policies, economic incentives, industrial structure regulation, legal policies, and command and control measures, promote efficient water utilization and decrease pollutant load generation. Although many measures and policies have been implemented in different countries to promote water quality standards during the urbanization process (Qin et al., 2014). Water pollution continues to be a serious issue.

4. Research Methodology–4.1 Variables definitions

This paper analyzes the decoupling relationship between marine pollution and marine economic growth in Shenzhen city during the period of rapid urbanization from a historical

perspective. Variables explanations are provided in the following sections.

4.2 Study area

Shenzhen is a typical coastal city located in Guangdong Province in the Pearl River Delta (PRD) in southern China and lies directly north of Hong Kong. Historically, Shenzhen consisted of only a few villages and small towns. However, the modernization of Shenzhen's cityscape is due to the economic reform and the open-door policy implemented in 1978 in China, in which Shenzhen was selected to be the first of China's five Special Economic Zones (SEZ). At the end of 2012, the city was considered China's southern mainland major financial center and the fourth largest economic aggregate nationwide, behind only Shanghai, Guangzhou, and Beijing. Due to the rapid expansion, urbanization, and the external population influx of the city, there have been accelerated changes in Shenzhen's coastal ecological environment, including marine pollution (Gong et al., 2013). Hence, Shenzhen's coastal zone ecological problems and its management make the city an ideal study area.

The study location is situated in the subtropical marine climate zone, which has four seasons with abundant rainfall (Yi et al., 2018). Due to its complicated topography, this coastal city zone displays numerous kinds of the coast's geological composition, subdivided into two segments, the west, and east, by the Kowloon Peninsula. The west coast between Shenzhen Bay in the south and the Dongbao River in the north is mainly mud flats, while the east coast is generally natural, including Dapeng and Daya Bay, with a rocky beach and shore. The coastal city physiognomy types diversity has contributed to the diversified advancement of the Shenzhen coast.

Coastline Water Quality Data

The Shenzhen coast comprises artificial coast, muddy coast, and a bedrock coast. Consequently, the coastline is covered by vegetation, mainly artificial coastal landscape forests and mangrove. To promote the Chinese marine ecosystem, policymakers, using marine activity data in 2006, established China's Ocean Economy Accounting System (OEAS) (Zhao et al., 2014). OEAS aimed to create the needed quality and range of ocean economy statistics at regional and national levels. Hence, this paper identifies the Shenzhen Ocean economy activities and marine economic growth via government-gathered data within national accounts. Additionally, the water quality in the Shenzhen catchment area has been measured since 1985

by the Environmental Monitoring Station of Shenzhen (Qin et al., 2014). This paper examines research studies characterizing Shenzhen's coastal zone water quality changes during the city's rapid urbanization using the target indicators parameters stated in China's environmental monitoring system.

Methods to Estimate the Pollutant Load

The pollutant load discharged into a water body directly impacts water quality changes during urbanization. However, the pollutant load in the Shenzhen catchment area has not been directly measured (Zhao et al., 2014). Therefore, studies have proposed different methods to estimate this discharge. Causes for pollutant load discharge variations during rapid urbanization are usually complex and varied.

Although they are either directly or indirectly connected to engineering interventions and social-economic developments. This paper investigates different studies providing useful items for understanding the causal relationships between marine pollution and marine economic growth in Shenzhen's coastal zone.

Empirical analyses and discussion

In this paper, the marine coastal economy is defined as all activities occurring in the Shenzhen coastal area. The primary ocean industries in China comprise coastal tourism, fishing, and marine transportation and communication (Zhao et al., 2014). However, new maritime industry types are emerging because of recent rapid advancements in marine science and technology. Thus, expanding the marine economy scope. The OEAS comprises four essential components, the Green Ocean Account, Elementary Account, the Natural Capital Account, and the Principal Account (Zhao et al., 2014). The Principal Account, also referred to as the Gross Ocean Product (GOP) Account, is focused on the recognition and quantification of ocean economic activity. On the other hand, the Elementary Account is focused on creating an input-output matrix that separates the primary ocean industries from the national input-output standard industry categorization tables (Zhao et al., 2014). Consequently, this account examines the value and quantity of imports and exports through Chinese seaports and approximates marine-related capital value. Thirdly, the Natural Capital Account evaluates the non-market values related to China's marine resources. Lastly, the Green Ocean Account merges the market and non-market assessments from the Natural Capital and Principal accounts to offer

policymakers a holistic interpretation of China's overall ocean economy value.

China's ocean economy comprises three content layers (Zhao et al., 2014). The core layer represents twelve significant industries which are marine fishery, offshore oil and gas, ocean mining, marine salt, shipbuilding, marine chemical, marine biomedicine, marine engineering and building, marine electric power, seawater utilization, coastal tourism and maritime communications and transportation industries (Zhao et al., 2014). They are the main ocean activities using ocean resources as the primary inputs or offering goods and services directly utilized in the marine ecosystem. Secondly, the support layer represents the education, research, scientific, and ocean management service sectors offering insightful information to the industries in the core layer. These support layer activities facilitate a platform to promote the sustainable development of the core layer industries. Lastly, the outer layer represents the ocean-associated businesses with an economic and technical link with the major marine sectors. Measuring China's total ocean economic activity is complicated since it is hard to get adequate base data for all the relevant ocean industries (Zhao et al., 2014). In the past, the traditional Chinese development models were characterized by extensive marine resources and space exploitation to extract marine life, mainly for human consumption (Zhao et al., 2014). Consequently, the coastal province's intense competition concerning the development of traditional maritime industries such as port activity, aquaculture and fishing was another aspect of past Chinese marine development. However, China's new marine development model emphasizes the conservation and management of marine ecosystem functions and resources and understands the significance of these resources to coastal tourism and emerging maritime industries (Zhao et al., 2014). Shenzhen boots of having the world's fourth busiest container port. The most significant marine sectors in the region are coastal tourism, marine transportation and marine oil and gas (Sun, 2021).

A few studies have explored the relationships between marine pollution, marine economic growth, and technological innovation in China using time series approaches. Shao (2020) provides a summary of literature papers showing a decoupling of marine economic growth and marine pollution in the case of China. Their analysis of the findings indicates that neither absolute nor relative level has not been attained.

However, analyzing the sample data from 2002–2013 reveals that the correlation between pollution and growth fluctuates with time (Shao, 2020). Recently, other studies have also found a

weak decoupling connection. Hence, there is a need for further marine economic advancement to cross the peak of the Environmental Kuznets Curve (EKC) and attain a negative relationship between pollution and growth to mitigate marine pollution. However, the marine carrying capacity and economic efficiency of the environment in which the marine resources exist have been continuously increasing and fluctuating, respectively, in China's coastal regions between 2005 and 2014 (Shao, 2020). Consequently, apart from marine economy growth, other factors, including the marine industry structure, scientific and technological capability and the degree of openness degree can also significantly impact marine resource intensity (an indicator used to gauge maritime resource utilization efficiency) at several levels. The marine industry structure and environmental protection technologies positively impact marine environmental efficiency (Xu & Zhang, 2022). In contrast, the investment level in marine scientific research, the maritime economy scale and economic development, and the external level of openness negatively impact marine environmental efficiency.

Also, researchers have utilized landscape pattern analysis to grasp the effects of rapid urbanization on the ecosystem. For example, Peng et al. (2015) connected landscape patterns and ecosystem services to examine Shenzhen's urban ecosystem health and its numerous coastal special economic zones. On the other hand, Yu et al. (2014) assessed the landscape connectivity of Shenzhen. Landscape pattern analysis is a valuable way of evaluating an ecosystem state. Therefore, it is crucial to analyze the effects of human activities on the coastal area's landscape pattern during periods of rapid urbanization. In the past four decades, Shenzhen has transformed from a laid-back fishing village to an enormous economic zone in southern China. However, the city's rapid advancement has come at a cost.

The naturally marshy environment aggravated by land cover alteration, local climate modification, and population density directly impacted the urban surface runoff and urban flooding leading to water pollution of catchment areas in the coastal zone. From 1990 to 2010, the Shenzhen coastal zone was in a period of rapid urbanization, although the urbanization rate hit the 100% mark by 2005 (Yi et al., 2018). During this period, sea reclamation was used mainly to expand the urban land in Shenzhen and added approximately 61.32 km2 of new land (Yi et al., 2018).

During the 1990s, many factories with high pollution emissions, such as dyeing and metalwork, chemical products and raw materials, and paper and paper-board, were introduced

into the Shenzhen water bodies without proper pollution control measures (Qin et al., 2014). This led to petroleum, heavy metal and organic pollution in the Shenzhen coastal waters. Besides, the wastewater infrastructure was poorly constructed and significantly impacted marine pollution in Shenzhen since the wastewater was collected, transferred, and discharged into the sea via long-distance discharge pipes (Qin et al., 2014). Additionally, some wastewater was not effectively managed (Yan et al., 2019) and treated before discharge because of poor environmental management, delayed sewer system construction, and detrimental behaviors of some residents in the early developmental phase(Qin et al., 2014).

According to Bao et al. (2016), the adverse consequences resulting from rapid economic developments in Shenzhen city are the increasing pollution of the Shenzhen River and the extensive pollution of water ecosystems in the entire region of Shenzhen Bay (Yan et al., 2019). Shenzhen Bay coastal water pollution is attributed to the sewage discharge in the entire coastal zone perimeters. Bao et al. (2016) discovered that Shenzhen Bay is extensively polluted during dry and wet seasons.

Simulation findings demonstrate that the Shenzhen land-based pollutants and the Shenzhen River are the primary causes of the severe water pollution of Shenzhen Bay (Bao et al., 2016). On the other hand, while Shenzhen's coastal tourism increased the region's gross domestic product, improved the city's image, created more jobs, and facilitated cultural interexchange and infrastructure development. Coastal tourism adversely impacted the marine biophysical ecosystem (Xu & Zhang, 2022). Its effects include the increase in water pollution and waste, the adverse modification in wetlands and the coastal zone waters due to a wide variety of tourism-related commercial sports and activities, and a reduction in the fish population because of recreational fishing.

Although the steady growth of Shenzhen maritime transport, including the establishment of port and logistics facilities, helped stabilize the region's social and economic development. It led to a significant production of greenhouse gases and other pollutants, which resulted in marine pollution (Liu et al., 2022). Specifically, Shenzhen's Sea freight congested port services and upstream logistics services lengthened the idling time of cargo and container ships at Shenzhen Bay, and the use of fossil fuels and engines significantly contributed to the environmental issues associated with marine pollution. In addition, aquaculture and maritime fishery and their associated service industries also contributed to marine pollution during rapid urbanization (Xu

& Zhang, 2022). The expansion of the aquaculture and maritime fishery led to higher exploitation of these resources, which surpassed their regeneration capabilities. Thus, leading to the degradation of fishery habitats.

Similarly, Shenzhen's rapid urbanization and anthropogenic discharge led to eutrophication in the region's estuarine and coastal waters. Previous studies have demonstrated that the coastal areas of Shenzhen are extensively contaminated by heavy metal contamination (Zhang et al., 2021). Consequently, various factors during rapid urbanization, such as tourism, industry, sewage discharge and aquaculture, led to significant changes in marine biodiversity.

Conclusions

The gradually serious marine pollution impacts coastal residents' health and high-quality economic developments. Hence, there is a significant need to explore the association between marine pollution and urbanization for the sustainable development of coastal areas. Based on the findings of different research studies containing concentration data of marine pollutants in Shenzhen Bay and China, this paper analyzes the decoupling relationship between marine economic growth and marine pollution in Shenzhen Bay. The main conclusions are that urbanization and marine economic growth result in marine pollution, and urbanization exacerbates marine environmental damage. The mechanisms by which urbanization impacts marine pollution include human capital, financial development and technological innovation.

Works Cited

Bao, Y., Huang, W., & Chen, X. (2016). Numerical simulation of water pollution in Shenzhen Bay. *Proceedings of the 2016 International Conference on Civil, Transportation and Environment*. https://doi.org/10.2991/iccte-16.2016.188

Cai, F., van Vliet, J., Verburg, P. H., & Pu, L. (2017). Land use change and farmer behavior in reclaimed land in the Middle Jiangsu coast, China. *Ocean & Coastal Management*, *137*, 107–117. https://doi.org/10.1016/j.ocecoaman.2016.12.015

Chang, H. (2005). Spatial and temporal variations of water quality in the Han River and its tributaries, Seoul, Korea, 1993–2002. *Water, Air, & Soil Pollution*, *161*(1-4), 267–284. https://doi.org/10.1007/s11270-005-4286-7

Chen, J., Wang, Y., Song, M., & Zhao, R. (2017). Analyzing the decoupling relationship between Marine Economic Growth and marine pollution in China. *Ocean Engineering*, *137*, 1–12. https://doi.org/10.1016/j.oceaneng.2017.03.038

Chen, K., Jiao, J. J., Huang, J., & Huang, R. (2007). Multivariate Statistical Evaluation of trace elements in groundwater in a coastal area in Shenzhen, China. *Environmental Pollution*, *147*(3), 771–780. https://doi.org/10.1016/j.envpol.2006.09.002

Crawford, T. W. (2007). Where does the coast sprawl the most? trajectories of residential development and sprawl in coastal North Carolina, 1971–2000. *Landscape and Urban Planning*, *83*(4), 294–307. https://doi.org/10.1016/j.landurbplan.2007.05.004

Deng, L., Liu, G.-hua, Zhang, H.-min, & Xu, H.-lin. (2015). Levels and assessment of organotin contamination at Futian Mangrove Wetland in Shenzhen, China. *Regional Studies in Marine Science*, *1*, 18–24. https://doi.org/10.1016/j.rsma.2015.01.001

Gong, C., Yu, S., Joesting, H., & Chen, J. (2013). Determining socioeconomic drivers of urban forest fragmentation with historical remote sensing images. *Landscape and Urban Planning*, *117*, 57–65. https://doi.org/10.1016/j.landurbplan.2013.04.009

Groppo, J. D., de Moraes, J. M., Beduschi, C. E., Genovez, A. M., & Martinelli, L. A. (2008). Trend analysis of water quality in some rivers with different degrees of development within the São Paulo State, Brazil. *River Research and Applications*, *24*(8), 1056–1067. https://doi.org/10.1002/rra.1091

Guo, W., Li, S., & Zhu, D. (2011). Modern geomorphological environment research during rapid urbanization in Shenzhen East Coastal Zone. *Journal of Geographical Sciences*, *21*(2),

372–384. https://doi.org/10.1007/s11442-011-0851-8

Halpern, B. S., Walbridge, S., Selkoe, K. A., Kappel, C. V., Micheli, F., D'Agrosa, C., Bruno, J. F., Casey, K. S., Ebert, C., Fox, H. E., Fujita, R., Heinemann, D., Lenihan, H. S., Madin, E. M., Perry, M. T., Selig, E. R., Spalding, M., Steneck, R., & Watson, R. (2008). A global map of human impact on marine ecosystems. *Science*, *319*(5865), 948–952. https://doi.org/10.1126/science.1149345

Huang, J., Wang, D., Gong, F., Bai, Y., & He, X. (2021). Changes in nutrient concentrations in Shenzhen Bay detected using landsat imagery between 1988 and 2020. *Remote Sensing*, *13*(17), 3469. https://doi.org/10.3390/rs13173469

Kannel, P. R., Lee, S., Kanel, S. R., Khan, S. P., & Lee, Y.-S. (2007). Spatial–temporal variation and comparative assessment of water qualities of Urban River system: A case study of the river bagmati (nepal). *Environmental Monitoring and Assessment*, *129*(1-3), 433–459. https://doi.org/10.1007/s10661-006-9375-6

Liu, Z., Liu, Z., Zhou, Y., & Huang, Q. (2022, September 15). *Distinguishing the impacts of rapid urbanization on ecosystem service trade-offs and Synergies: A case study of Shenzhen, China*. MDPI. Retrieved November 8, 2022, from https://www.mdpi.com/2072- 4292/14/18/4604

Mori, N., & Takemi, T. (2016). Impact assessment of coastal hazards due to future changes of tropical cyclones in the North Pacific Ocean. *Weather and Climate Extremes*, *11*, 53–69. https://doi.org/10.1016/j.wace.2015.09.002

Pavlicevic, D. (2015). China, the Eu and One Belt, One Road Strategy. *China Brief*, *15*(15).

Peng, J., Liu, Y., Wu, J., Lv, H., & Hu, X. (2015). Linking ecosystem services and landscape patterns to assess Urban Ecosystem Health: A case study in Shenzhen City, China.

Landscape and Urban Planning, *143*, 56–68. https://doi.org/10.1016/j.landurbplan.2015.06.007

Qin, H.-peng, Su, Q., Khu, S.-T., & Tang, N. (2014). Water quality changes during rapid urbanization in the Shenzhen River Catchment: An integrated view of socio-economic and Infrastructure Development. *Sustainability*, *6*(10), 7433–7451. https://doi.org/10.3390/su6107433

Ren, W., Zhong, Y., Meligrana, J., Anderson, B., Watt, W. E., Chen, J., & Leung, H.-L. (2003). Urbanization, land use, and water quality in Shanghai. *Environment International*, *29*(5), 649–659. https://doi.org/10.1016/s0160-4120(03)00051-5

Shao, Q. (2020). Nonlinear effects of marine economic growth and technological innovation on
MARINE POLLUTION: Panel threshold analysis for China's 11 coastal regions. *Marine Policy*, *121*, 104110. https://doi.org/10.1016/j.marpol.2020.104110

SKLAIR, L. E. S. L. I. E. (1991). Problems of Socialist Development: The significance of
shenzhen special economic zone for China's Open Door Development Strategy.

International Journal of Urban and Regional Research, *15*(2), 197–215.
https://doi.org/10.1111/j.1468-2427.1991.tb00630.x

Sun, L. (2021, December 9). China's Shenzhen rolls out support for marine industries as country
looks to tap blue economy. *China Macro Economy*.

To, W.-M., & Lee, P. (2018). China's Maritime Economic Development: A review, the future
trend, and Sustainability Implications. *Sustainability*, *10*(12), 4844.
https://doi.org/10.3390/su10124844

Wu, R., & Zhang, M. (2013). Research on the tourism effect and marketing strategy of
Convention & Exposition Industry: A case study of shenzhen city of China. *Journal of Service Science and Management*, *06*(02), 151–159.
https://doi.org/10.4236/jssm.2013.62015

Xu, W., & Zhang, Z. (2022). Impact of coastal urbanization on Marine Pollution: Evidence from
China. *International Journal of Environmental Research and Public Health*, *19*(17),
10718. https://doi.org/10.3390/ijerph191710718

Yan, H., He, X., Lei, Y., Wang, Y., Su, H., & Jiang, S. (2019). Land use-induced change in
trophic state of Shenzhen Bay (south china) over the past half-century. *Marine Pollution Bulletin*, *145*, 208–213. https://doi.org/10.1016/j.marpolbul.2019.05.046

Yi, L., Chen, J., Jin, Z., Quan, Y., Han, P., Guan, S., & Jiang, X. (2018). Impacts of human
activities on coastal ecological environment during the rapid urbanization process in
Shenzhen, China. *Ocean & Coastal Management*, *154*, 121–132.
https://doi.org/10.1016/j.ocecoaman.2018.01.005

Yu, D., Liu, Y., Xun, B., & Shao, H. (2014). Measuring landscape connectivity in a urban area
for biological conservation. *CLEAN - Soil, Air, Water*, *43*(4), 605–613.
https://doi.org/10.1002/clen.201200448

Zhao, R., Hynes, S., & Shun He, G. (2014). Defining and quantifying China's ocean economy.
Marine Policy, *43*, 164–173. https://doi.org/10.1016/j.marpol.2013.05.008

Zhang, R., Liu, W., Liu, Y., Zhang, H., Zhao, Z., & Zou, L. (2021). Impact of water quality
variations on the microbial metagenome across coastal waters in Shenzhen, South China.
Ocean & Coastal Management, *208*, 105612.
https://doi.org/10.1016/j.ocecoaman.2021.105612

Diversity and Inclusion in Hong Kong Workplace Focusing on the Education Industry By Yixuan Wang

Introduction/Methodology

The article is mostly based on theoretical research and discusses the main theories connected to diversity and inclusion in China, focusing on workplaces in Hong Kong in the industry of education. We have used 4 interviews (2 women, and 2 men)) who works or have worked in the industry of education in China.

The keywords: Inclusive society, Diversity; People with a disability; LGBTQ society; Gender stereotypes; Education problems.

China is the largest developing country in the world and has more than 1,4 billion of population. Administratively, China is divided into 23 provinces, 5 autonomous, 4 municipalities and 2 Special Administrative Regions (Hong Kong, Macao). Mainland China is also classified into different geographic areas, specifically eastern, central and western regions(UNICEF). The main challenges to the country are connected to economical situations. Economically, China is one of the leading in the world. In the report of UNICEF is mentioned, that economic and human development indicators are lower in the western region, compared to the eastern region (UNICEF).

The country itself is diverse, which means that except economic situation, China has a lot of challenges connected to social norms, diversity and inclusion. The definition of diversity includes differences in personal, social, and even thinking styles. It can be visible dimensions like physical aspects, age, ethnicity, or invisible influences such as culture, religion, education and sexual orientation. Inclusion puts the concept and practice of diversity into action by creating an environment of involvement, respect, and connection - where the richness of ideas, backgrounds or cultures and perspectives are accepted, welcomed, equally treated and valued (Zhang, 2021, p. 9).

But, in some researchers' opinions, in China diversity issues are not noted as top challenges. It may be that in fact diversity is not an issue in attracting and retaining talent in China or it may be that there is simply not sufficient understanding of diversity (Nathwani et.al., p.20).

In the financial sector, "diversity" often refers to having staff or customers with different dimensions such as gender, ethnicity, sexual orientation, age, social background and physical or mental ability, while "inclusion" means valuing and accepting people for who they are and providing them with equal and fair opportunities. Diversity and inclusion can be considered internally in a financial institution in terms of the composition of its board of directors, management and staff members, or externally in terms of its dealings with customers and the public. One of the main focuses of diversity has been on gender, but the scope is expanding to cover other diversity dimensions, including age, disability, race and ethnicity (Nompumelelo & Jeffery 2022 p.4).

Under China Mainland law, employees should enjoy the right to be employed on an equal basis under the law. Employees should not be subject to any discrimination arising from differences in terms of nationality, race, gender and religious belief. Schrader Anke makes a brief review of Chinese (mainland) law connected to diversity ad mentions, that From the rights to equal employment opportunities in particular are covered in the Chinese Constitution, the Labor Law, the Law on the Promotion of Employment, the Law on the Protection of Disabled Persons, the Regulation on Employment of Persons with Disabilities, as well as additional laws and regulations ensuring equal access to education, training, and economic assistance programs related to employment. As a signatory of the United Nations Convention on the Rights of Persons with Disabilities, China has also taken an internationally binding pledge to implement and enforce legislation that protects equal rights to employment and eradicates discrimination of any kind in the pursuit of work and career advancement (Schrader & Bruyère 2018 p.7).

The labour law of China doesn't separate gender and clarifies that women should enjoy equal employment rights to men. When companies are recruiting employees, women should not be refused on the grounds of sex, nor should the recruitment standards for women be raised, except in those types of work or positions of work that are unsuitable for women as stipulated by the law. (Zhang, 2021, p.9)

One of the most interesting and important cities is Hong Kong, which is located in southern China. A place with a cross-exchange of Eastern and Western characteristics, as well as a mix of cultures, religions and ethnic groups existing side by side in a harmonious way. In the research "*Diversity in Education in the Hong Kong Special Administrative Region*", the author highlights the main and unique challenges to Hong Kong and says, that today they are related to

diversity, as a special administrative region of China, operating under the "one country-two systems" principle as a semi-autonomous, liberal society within communist China. Modern diasporic movements of populations both across and within countries impact social diversity at multiple levels of scale, i.e., politics and teaching and learning issues from pre-primary to higher education (Bridges, et.al., p.2)

As one of the leading cities in China, Hong Kong is a perfect destination for the youth, students and every person, who is going to build a carrier. It makes the city diverse and very active. During the development of the technical industries, education system, enterprises and other kinds of profit and non-profit organizations, Hong Kong requires people for workplaces and the companies have a lot of challenges connected to make the atmosphere inclusive and diverse adapted to the citizens of the city.

From the vulnerable and even marginalized groups in Hong Kong, we can separate first of all people with disabilities. The research showed up, that living in China for them, as in many other developing and even developed countries, is full of challenges in every field. In Hong Kong lives 137,152 disabled persons, and in China, the number is more than 85 million. Schendler highlight the main factors of unemployment among persons with a disability in China: inadequate access to education and training in marketable labour skills, negative societal attitudes, prejudices and disinterest in workplaces and the overall labour market, and a lack of proactive enforcement of rights and funding of effective programs on the part of the government. (Schrader & Bruyère 2018 p.10).

In her opinion, they are marginalized due to stigma, discrimination, and a lack of successful government strategies. They are marginalised economically and socially, with limited access to education, training programs, and work opportunities. Even more discouraging from a sustainability viewpoint, regulatory protections rather than open market forces are responsible for the majority of jobs filled by persons with disabilities. (Schrader & Bruyère 2018 p.5).

Eric Zhang Guozhong in his article *"Inclusion of person with disability in China"* mentions, that China's constitution provides a general principle on the protection of people with disabilities. *"All citizens ... have the right to material assistance from the state and society when they are old, ill or disabled.* The state develops the social insurance, social relief and medical and health services that are required to enable citizens to enjoy this right..." and "the state and society help make arrangements for the work, livelihood and education of the blind, deaf-mute and other

handicapped citizens. In addition, more than thirty national laws contain specific provisions concerning people with disabilities and the protection of their rights, including Civil Law, Criminal Law, the Law of Education, Law on Higher Education, Labour Law and so on (Guozhong, 2006).

One of the main challenges and problems for PWD in China is education and workplaces. Less education is the reason of poor social and economic lifestyles during their life. During the interviews, informants mentioned, that they have never worked with disabled persons. Despite that, Eric Zang mentions, that in China, the right to work is guaranteed by the Law, which states that, "no discrimination shall be practised against disabled persons in employment, engagement, status regularisation, promotion, determining technical or professional titles, payroll for labour, welfare, labour insurance or in other aspects." Correspondingly, employers like state-run welfare enterprises should not deny people with disabilities employment (Guozhong, 2006).

"I believe, that the major difficulty for physically disabled persons is the lack of space in a crowded city like Hong Kong. As the overpopulation and very limited space, it is pretty hard for disabled persons, who might need help with tools or equipment like wheelchairs or sticks. And people surrounding them might find them occupying too much space, especially in very crowded subways or buses. The major problem is the lack of space generally in this city." (Kiki 27 years old, teacher from Hong Kong)

Diversity and inclusive society come from education. The first step, where the people can learn what means and why is important to live in an inclusive atmosphere, comes from the first years of school. So, education has one of the important roles in the future inclusivity of humanity.

The government of the Hong Kong Special Administrative Region (HKSAR) is promoting inclusion by encouraging all schools to accept children with special education needs through employing a whole-school approach (WSA) towards education (Forlin,& Sin p.9).

The field of education is open to foreign teachers, who are ready to live and teach English languages in kindergarten and schools. Those teachers are spending a few years in China, mostly in rural areas.

One of our informants, who lived in China and taught in a primary school in a small town near Hong Kong (she doesn't mention the name of the school and town) with the program "Early Bird in China", mentioned:

"Living in China was full of challenges, I lived in a town where were not too many foreigners. People were very friendly to me, but the atmosphere around me was not inclusive. For example, in the school the teachers were not ready to teach disabled children, the citizens were conservators and living there somehow was stressful **(*<u>Tako, 29 years old from Georgia, lived in China for two years</u>).***

With the results of the research of Forlin and Sin, in Chinese schools, 40% of teachers indicated that they had already had previous considerable interaction with people with disabilities, although only 11% had received at least 40 hours of training on educating students with disabilities, with the majority of 60% having had no training prior to the course. Similarly, only 13.5% had at least 30 full days of teaching experience with students with disabilities, although 40.5% had some experience. Their knowledge of policy as it related to people with disabilities was generally non-existent (60%) or poor (39%). Just over one-half of the teachers held average confidence in teaching students with disabilities, with 37% expressing low or very low levels of teaching confidence (Forlin,& Sin p.14). Susan M. Bridge also considers teachers' education as a basic point to develop inclusivity in Hong Kong. According to an Equal Opportunities Commission study, in some schools, less than 10 per cent of teachers have any special education training. Catering to students with diverse learning needs has become a compulsory module for preservice teachers to equip them for their future teaching careers. However, special education programs still lack components in curriculum design for inclusion (Bridges, et.al., p.4).

Making education available to all is seen as one of the most powerful levers to making society more equitable as it enhances social cohesion and trust. Inclusion is now considered to be a much broader philosophy that seeks to address inequity and fairness by focusing on the inclusion of all students regardless of disability, gender, ethnicity or other disadvantages (Forlin,& Sin p.9).

"From now on, I haven't seen any disabled work around me in any fields or industries. I think most of them are hard to be employed because of their inconvenience (I don't mind calling this discrimination). So what do they do for a living? A small part of them has to work hard to

make a living, like open their own small business"(Anshen, 32 years old, a head teacher from Hefei).

"I have never worked with disabled persons (he is a teacher), but as far as I know, the government did some efforts to help physical disabilities. But it is impossible for the disabled to have equal opportunities as normal people. If you are the business owner what will u do? but there are some enterprises that did a good job. For example, the "Baixiang" food company in China (Jack, English teacher in China, 10 years of experience teaching in schools).

"Hong Kong is an international city and is overall advanced, we have anti-discrimination laws, and companies can get benefits and subsidies for supporting the employment of disabled persons. However, I don't think it would be possible to reach the "equal opportunities" part in most situations. There will be limitations for disabled individuals. But, to be fair, a lot of organizations are more willing to hire disabled persons and it is getting easier for them to get working experiences nowadays, so I believe it's an improving trend, yet, I still think it is way too early to say there is equal opportunity out there" (Kiki, 27 years old, art teacher in Hong Kong).

In the world, mostly in developed countries, the workspaces are inclusive. It means, that the working area mostly is oriented and adapted to the needs of people despite their sex, age, physical disability, orientation, etc.

Ideally, an inclusive workplace atmosphere will create an environment that encourages open-minded communication, stimulates innovation, and provides opportunities for all, employees to be creative in their work. When people conduct business, a diversified workforce and corporate culture play an influential role. Diversified teams promote more innovation and improve corporate performance, which in turn can motivate employees to be more dedicated.

China has a legal and moral obligation to ensure an environment where persons with disabilities can be equal and active members of society (Schrader & Bruyère 2018 p.7). From a human rights perspective, realizing the individual's right to dignity through work necessarily entails looking beyond pure employment figures, and understanding deeper societal trends which contribute to the barriers faced. These include deeply rooted prejudices against persons with disabilities, widely practised discrimination in everyday life and the workplace, as well as a general lack of government enforcement of legislation, that would help enable greater participation (Schrader & Bruyère 2018 p.7).

From the perspective of the employer, working with PWD is connected to the many stereotypes and fairness. Yi and Maziourine described some of them and mentioned, that the reason can be a lack of knowledge and resources available to find potential employees with disabilities that possess the right skills and experience (Yi & Mazourine, 2015).

■ Limited access to education and appropriate training for people with disabilities.

■ Some employers would rather pay a fine for failing to meet the government-instated quota, than hire a person with a disability.

■ Negative perceptions and false assumptions about individuals with disabilities' capabilities to perform at work.

 ■ Employers' limited experience of working with or interacting with people with disability.

 ■ Lack of adapted infrastructure such as workplace accessibility or office tools (Yi & Mazourine, 2015).

A majority of persons with disabilities work at the bottom of the wage spectrum (people working in agriculture) and earn roughly half of what is earned in other low-income sectors, like manufacturing and construction. Urban households with persons with disabilities also receive a much lower share of their income from wages than average urban households—35 per cent compared to 64 per cent. This suggests, that most urban households with disabled members depend to a great extent on supplementing wage income with other sources. For example, payouts of social welfare programs or familial support (Schrader & Bruyère 2018 p.10).

Another very marginalized groups in China are LGBTQ population, totally they are 3-5 % of the society, but many of them hide their orientation in workplaces. In Chinese society, the visibility of sexual minorities is still extremely low. In schools, workplaces, or religious communities, only about 5% of sexual minorities choose to disclose their sexual orientation, gender identity or unique gender expression, more people come out to close family members, but even this group of people only accounts for 15% of the sexual minorities (UNDP, 2016). As of yet, there are no laws in China that protect LGBT employees from discrimination in society or the workplace.

YI and Zaziourine described a case when one employee was fired from his job after he was revealed as gay in a video that went viral online that showed him arguing with another gay man on a Shenzhen street. After it was posted online, he was subsequently fired from his job as a

designer. The man sued his employer claiming he was being unfairly discriminated against because of his sexual orientation and is claiming 50,000 CNY and an apology as compensation. He says his employer is infringing on his right to equal employment. The employer maintains that his firing was not because of his sexual orientation, but rather due to his poor service attitude. The court has yet to reach a verdict (Yi & Mazourine, 2015, p.4)

Conclusion

As the research showed up, the main challenge for Hong Kong was and still is the education field, stereotypes and stigma from the society connected to marginalized groups. Because of the value of the city, it's diverse and full of people from different societies, sexual orientations, disabilities, etc. For the government of Hong Kong keeping an inclusive atmosphere still stays one of the biggest challenges.

The field of education is somehow trying to become inclusive. Inclusivity in this field means to be inclusive for the pupils, but not for the teacher or other employees in the field. In the interviews, our informants mentioned, that they have never had a colleague with a disability, and the workplace can't be inclusive for them.

Engaging fully with inclusive education requires teachers to be able to accept responsibility for modifying the curricula for different learners (Forlin,& Sin p.2). Education programs on the benefits of diversity and inclusive practices will help to create working environments that optimise the impact of differences. They can also show how to work with differences to achieve better business outcomes.

China's significant efforts to create a legal framework for the protection of the rights and interests of persons with a disability constitute an important step forward, but it has yet to effectively overturn stubborn patterns of exclusion and discrimination. Prejudices persist strongly in the workplace—it is still widely thought that persons with a disability can't productively contribute to economic growth (Schrader & Bruyère 2018 p.12). The most inclusive atmosphere, if we can say that, is in the field of commercial companies and enterprises YI and Zaziourine summarize their research results and list Diversity Best Practices in China TALENT:

• Hunan Anbang Pharmaceutical employing over 300 people with disabilities (disabilities WorkForLGBT, a platform to promote inclusive employment and workforce for LGBT professionals (LGBT) ;

• Wanda - Job fair in Guizhou for candidates from disadvantaged backgrounds (origin) CONSUMER & MARKET;

• Taobao advertising pink market (LGBT) ;

• Industrial Bank ATM accessibility (disabilities);

• Geely accessible car (disabilities) EMPLOYEE ENGAGEMENT;

• Alibaba capacity training for people with disabilities (disabilities);

• Sodexo mentoring program for Women (gender);

• IBM, welfare plan for same-sex couple (LGBT) POLICY & STRATEGY;

 • L'Oréal diversity workshop for all managers and management trainees (diversity) CSR • L'Oréal solidarity sourcing (diversity) SOCIAL BUSINESS;

• Buy42.com, inclusive workplace and its charity sales revenue supporting people with disabilities (disabilities);

• Tomuni, an inclusive restaurant employing people with intellectual disabilities (disabilities);

• Xiaolongbao, a design agency that employs and provide job-seeking related training for young people with hearing disability (Yi & Mazourine, 2015, p.6).

Governments should improve to increase diversity in China, also they have to keep the right specially to disable and LGBTQ people in the workplace, and encourage businesses to create -inclusive work environments.

Works Cited

BRIDGES SUSAN M., JACKSON LIZ, YEUNG PATCY, CHAN KIT, MOK IDA A. C.,
AISTON SARAH JANE- Researching Diversity in Education in the Hong Kong Special
Administrative Region, International Journal of Diversity in Education · September 2016
DOI: 10.18848/2327-0020/CGP

Forlin Chris, Sin Kuen–fung, Developing support for inclusion: A professional learning
approach for teachers in Hong Kong, The Hong Kong Institute of Education,
INTERNATIONAL JOURNAL OF WHOLE SCHOOLING VOL. 6. No.1, 2010

Guozhong Eric Zhang - Inclusion of person with disability in China, 2006 January

Li Chunxiao , Ka Lam Sam Sam - Current Situation and Prospect of Inclusive Physical
Education in Mainland China, Asian Journal of Physical Education & Recreation Vol.17
No.1

Liang Xiao, Li Minghui, Wu Yandan , Wu Xueping, Hou Xiaohui, Hui-Ping Cindy - A
socio-ecological approach to inclusive physical education in China: A systematic review

Moher David, Bouter Lex, Foeger Nicole, Dirnagl Ulrich - Incorporating equity, diversity, and
inclusiveness into the Hong Kong Principles

Nathwani Anjana, Alves Freddie , Schneider~Ross Limited, Diversity and Inclusion A Lever for
Solving Talent Pool Dilemmas in India and China, August 2007

Oishi Nana - Workforce Diversity in Higher Education, The Experiences of Asian Academics in
Australian Universities,

Schrader Anke, Bruyère Susanne M, Barrington Linda, Mitchell Charles, Hao Yuling, Xie Minji
- Disability in the Workplace in China: Current Realities and Ways Forward, December
2018

Simelane Nompumelelo, Yong Jeffery - Diversity and inclusion – embracing the true colours in
financial supervision, May 2022

Tang Ningyu , Xingshan Zheng , Chen Chiyin Managing Chinese diverse workforce:toward a
theory of organizational inclusion, Journal: Nankai Business Review International

Tang Haoning, Yu Wanlu - LGBTQ inclusive workplace climate in China, 2021, Bachelor
Degree Project in Business Administration

UNCOVERING: THE ECONOMIC BENEFITS OF LGBT WORKPLACE INCLUSION,
FOCUS GENDER AND BUSINESS , DECEMBER 2019

UNDP – Being LGBT in China, 2016

UNICEF - Geographic regions of China, CHAPTER 1 POPULATION DEMOGRAPHICS

Yi Liu, Mazourine Cecile - Diversity and Inclusion in the Chinese Workplace, JULY, 2015

Zhang William WL - Global labor and employment law strategic topics DE&I — Diversity,
        Equity & Inclusion July 2021 Edition #2

Which Characteristics Distinguish Successful Movements for Social Change From Unsuccessful Ones? By Fung La

Abstract

With the rise and fall of many social movements in recent years, a question is raised: how does one achieve change through social movements? Although there is not a formula that would guarantee success, there are certain factors that would help a social movement develop. To effectively spread their message, these movements need to be well structured and controlled, with strict leadership that is able to manage large amounts of resources and people. Stemming from these leaders, it is also important to preserve core values and market them clearly to target audiences and gain momentum. Finally, to keep up with current developing technologies, it has become a norm – perhaps even a necessity – for social movements to promote their ideals on social media platforms.

Key Words: Success, formula, social movements, leadership

Social movements are nothing new. As contrasting opinions exist within a community, unaligned goals spark internal conflict – solutions to these conflicts cause change. Groups of people with like interests band together to strive for their ideal society, but similar groups with opposing opinions suppress their efforts. Because of this inevitable pushback, most social movements struggle to achieve their goals and frequently take over decades to materialize change. Although there is no specific strategy that guarantees the success of a social movement, many successful social movements share common traits; for instance, a clear and compelling message.

A tangible objective, or at least direction, that is transparent to the public helps a group gain traction and build momentum among the public. A central message is a powerful tool that can influence how individuals think about an issue or cause. For example, the message of the Civil Rights movement in the United states was simple and direct: to end racial segregation and discrimination. This resonated with many Americans and their struggles. With a sense of unity embodied in the movement's slogan, "We Shall Overcome," it rallied activists and supporters (Van Dyke & Amos, 2017).

In order to establish a strong message, effective organization from within the social movement is necessary; leaders establish strategies to mobilize resources and maintain the momentum of these movements. According to Crutchfield (2018), successful organizations encompass three traits: the ability to empower local grassroots leaders, to build around coalitions of like-minded individuals, and to be educated about the issue they tackle. Recent movements like #BlackLivesMatter and the advocacy for gun rights reflect these factors. Another well-organized movement is the feminist movement of the 1960s and 1970s. Feminist activists established a strong network of organizations and grassroots groups to collaborate and push for social change. A charismatic leader, Betty Friedan, played an essential role in shaping feminist movements in the United States; her book, *The Feminine Mystique*, inspired many women to fight for gender equality and participate in the ongoing feminist movement.

Furthermore, the disability rights movement achieved significant gains through effective organization. One prominent leader of the disability rights movement was Judy Heumann, who advocated for disability rights for over 40 years. Heumann was instrumental in organizing protests and sit-ins that led to the enactment of the Rehabilitation Act of 1973, which prohibited discriminatory practices against people with disabilities in public programs (Nardini et al., 2021).

Key components in expanding social movements are inclusivity and diversity – by attracting support from different communities, or influential figures, social movements are able to broaden their target audience, and therefore increase the number of their supporters. Furthermore, a diverse population offers a broader range of perspective and past experiences to draw upon in order to better the organization as a whole. An example of a movement that has been successful in building alliances with other communities is the LGBTQ rights movement. LGBTQ activists have collaborated with political supporters in addition to religious leaders to push for greater acceptance of legal protection for LGBTQ individuals (Nardini et al., 2021).

As society develops, it is essential for effective social movements to take advantage of modern technologies such as social media and online tools – as they become increasingly central to our society, the high amount of exposure that social media brings can be utilized for organizational and advertising purposes. As an example, the Arab Spring took advantage of social media to mobilize millions to achieve significant political change by spreading their message and connecting their supporters, even on a global scale (Nardini et al., 2021).

To shift the opinions of the masses, social movements need to provide an alternate interpretation of existing issues; long-term change can only occur if the attitudes of the public shift. The #MeToo movement, for example, challenged the existing attitude towards sexual harassment and assault, spreading awareness about these issues and bringing them to the forefront of public consciousness (Crutchfield, 2018). By empowering survivors to share their compelling stories and protest sexual harassment and assault, this movement was able to create significant change in laws, politics, and social attitude. Similarly, the compelling message of the Civil Rights movement, for the African Americans to have equal rights, was able to reach the world though their nonviolent resistance tactics – they appealed to the moral consciousness of the American people to challenge the wrongfully established social norms concerning race and discrimination of the 20th century. Ultimatelty, these tactics were successful, and led to the enactment of the Civil Rights Act of 1964 and the Voting Rights acto of 1965, which prohibited legal segregation and guaranteed equal access to the ballot box.

In contrast, unsuccessful social movements frequently fail to build a large supporting community and momentum required to achieve significant change. The Occupy Wall Street movement, launched in 2011 to respond to the increasing inequality and corporate power, failed because of their unclear agenda. Although the movement succeeded in raising awareness of these issues and igniting a countrywide debate, it eventually failed to realize its goals of systematic change. Its unclear purpose made it challenging to mobilize support and build momentum.

A factor that can help social movements persevere through opposition is their ability to sustain their initiatives and have momentum in their activities. By sticking to their central purpose, willing to adapt and compromise in the process, a social movement can endure through challenges. As a prominent example, the Environmental Protection movement has survived for so long because of how they were able to adapt their policies through changing political climates and environmental factors (Crutchfield, 2018). As our knowledge of climate-change increases and scientific understanding develops, this movement

The objectives of a social movement need to be feasible, with respect to both internal and external factors, to solve problems and achieve lasting change. Existing studies posit that an established purpose to a movement is necessary for their advocacy efforts to bear fruit; a social movement needs to provide a united front to the public to attract attention and gain momentum (Satell, 2016). Without a clear path to success, it is difficult for a social movement to obtain

public support. Possible obstacles to a feasible goal are legal, organizational, and financial issues. For instance, some social movements that focused on organizing large groups to protest certain systemic policies have resulted in chaos, riots, and the destruction of property. Once demonstrations of a particular movement become violent, the government must intervene to protect civilians and property -- consequently, law enforcement agencies will be deployed to contain the riots and prevent further damage (Sempere, 2019). An unsuccessful movement can create chaos instead of bringing about social change.

For the elements to success to exist, strong leadership is necessary to keep a social movement on track. The movement to end apartheid in South Africa was successful because of the contribution of iconic leaders such as Nelson Mandela. Effective leaders inspire members of the movements by their actions and act as a cornerstone of the movement – they support the initiative to the end. Like other organizations, social movements require structure to ensure members share similar ideologies (Satell, 2016). This will prevent any unwanted collective behavior that may jeopardize the social movement's call to action. Proper leadership will steer their movement away from obstacles such as legal or political battles though their experience and foresight. The integrity of a leader often spreads to the group itself, helping the unit maintain its drive and continue to work toward its goals.

Opposingly, a characteristic of unsuccessful social movement is the loss of interest of members and supporters over time – without the proper personnel and commitment, it is difficult to maintain initiative and achieve success. Because social movements are based on shared ideologies, it is difficult for all members to maintain their sense of unity. As times change, opinions do the same, leading to internal conflict that stagnates progress.

Financial resources are central to the power of a movement and their succeeding capabilities. Some movements, like the #MeToo campaign, have a strong financial backing that plays a vital role in mobilizing members and communicating ideologies to the public. The cost of running a social movement can be overwhelming without the right backing and support. Unsuccessful movements lack money and other resources that would otherwise be needed to push the group's agenda and initiate social change (Bartkowski, 2017). Money is necessary to the progress of a given movement as the costs of advertising and attracting work are high.

To persist through difficulties, it is necessary for a social movement to have the ability to maintain their core values, or purpose. Despite the significance of fighting against oppression and championing social justice, some have failed in their effects to bring change to the community. Existing studies posit that a lot goes into establishing a social movement and mobilizing members to act accordingly. Successful social movements are driven by values that go beyond the slogans they adopt (Dundua, Amashukeli, & Tabatadze, 2022). This has been instrumental in boosting integrity and maintaining orders within the group to avoid instances where members' actions are not in the best interest of the group. Some of the values of a movement maybe have a close relation to cultural values and beliefs of the people. Such an approach will improve how the group resonates with the community, which in turn provides support.

In conclusion, successful social movements share several key characteristics that enable them to achieve lasting and transformative change. These include a clear and compelling message, effective organization and leadership, inclusiveness and diversity, the ability to leverage new technologies and communication platforms, and resilience and persistence. Although these traits do not guarantee success, they offer a solid foundation for building momentum and realizing long-term change. Therefore, by exploring successful social movements in history, we can learn valuable lessons about establishing and sustaining social change today and tomorrow. At the same time, we take collective action to create a more just, equitable, and sustainable world through participating and supporting different movements in an ever-changing world.

Works Cited

Bartkowski, M. (2017, December 5). *Why Do Some Movements Fail to Bring Positive Outcomes, and How Can This Be Changed?* ICNC. https://www.nonviolent-conflict.org/blog_post/movements-fail-bring-positive-outcomes-can-changed/

Crutchfield, L. R. (2018). *How change happens: why some social movements succeed while others don't*. John Wiley & Sons.

Dundua, S., Amashukeli, T., & Tabatadze, S. (2022). What Makes Social Movements Successful: The Case of Gudiashvili Square. *Europe-Asia Studies*, *74*(8), 1413-1432.

Feinberg, M., Willer, R., & Kovacheff, C. (2020). The activist's dilemma: Extreme protest actions reduce popular support for social movements. *Journal of personality and social psychology*, *119*(5), 1086.

Gordiychuk, K. (2021, August 21). *The perfect social movement - is there a recipe? This expert explains*. World Economic Forum. https://www.weforum.org/agenda/2022/08/social-movements-hahrie-han-expert-explains/

Lofland, J. (2017). *Social movement organizations: Guide to research on insurgent realities*. Routledge.

Markoff, J. (2015). *Waves of democracy: Social movements and political change*. Routledge.

McVeigh, R., Welch, M. R., & Bjarnason, T. (2003). Hate crime reporting as a successful social movement outcome. *American Sociological Review*, 843-867.

Mundt, M., Ross, K., & Burnett, C. M. (2018). Scaling social movements through social media: The case of Black Lives Matter. *Social Media+ Society*, *4*(4), 2056305118807911.

Nardini, G., Rank‑Christman, T., Bublitz, M. G., Cross, S. N., & Peracchio, L. A. (2021). Together we rise: How social movements succeed. *Journal of Consumer Psychology*, *31*(1), 112-145.

Nguyen, T. (2021, February 28). *Behind the Success of Recent Social Movements*. Tronvig. https://www.tronviggroup.com/success-of-recent-social-movements/

Oberschall, A. (2017). *Social movements: Ideologies, interests, and identities*. Routledge.

Offe, C., & Offe, C. (2019). *New Social Movements: Challenging the Boundaries of Institutional Politics (1985)* (pp. 255-294). Springer Fachmedien Wiesbaden.

Satell, G. (2016, November 30). *What Successful Movements Have in Common*. Harvard
Business Review. https://hbr.org/2016/11/what-successful-movements-have-in-common

Schwartz, G. Z. (2021, March 16). *How "Good" Social Movements Can Triumph over "Bad"
Ones*. Scientific American.
https://www.scientificamerican.com/article/how-lsquo-good-rsquo-social-movements-can
-triumph-over-lsquo-bad-rsquo-ones/

Sempere, N. (2019, October 4). *Why do social movements fail: Two concrete examples. - EA
Forum*. Forum.effectivealtruism.org.
https://forum.effectivealtruism.org/posts/7Pxx7kSQejX2MM2tE/why-do-social-moveme
nts-fail-two-concrete-examples

Staggenborg, S. (2016). *Social movements*. Oxford University Press, USA.

Van Dyke, N., & Amos, B. (2017). Social movement coalitions: Formation, longevity, and
success. *Sociology Compass*, *11*(7), e12489.

Yates, L. (2015). Rethinking prefiguration: Alternatives, micropolitics and goals in social
movements. *Social Movement Studies*, *14*(1), 1-21.